LITERATURE ON PINES
A BIBLIOMETRIC ANALYSIS
1994–98

DISSERTATION

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CERTIFICATE

This is to Certify that ***Mr. Mukesh Chand*** *has completed his dissertation entitled "****Literature on Pines: A Bibliometric Analysis 1994-98****" in partial fulfilment of the requirements for the degree of Master of Library & Information Science. He has conducted the work under my supervision & guidance. I deemed it fit for submission.*

Mr. S. Mustfa Zaidi
Reader

DEDICATED

TO

My Parents

&

BROTHERS WITH LOVE

Those who sacrificed all for me
I would sacrifice something for them

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ACKNOWLEDGMENT

The present dissertation entitled "literature on Pines: A Bibliometrics analysis 1994-98" is being submitted to the Department of Library and Information Science, A.M.U., Aligarh, in partial fulfilment for the award of the degree of Master of Library and Information Science.

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(MUKESH CHAND)

PREFACE

Information is a part of our day to day life. Information activities in library science has a much more significant place. The value of information is increasing because dynamic growth in every field of study has made tremendous advancement.

For making a limited collection, it is essential for information manager, to find out some special techniques which would help in making a better choice, of these special techniques. Bibliometric Analysis is one of the quantitative technique applied by information managers to measure the record of human communication.

Here bibliometric analysis technique is used on literature of Pines which has witnessed termendous growth in the field of forest and forestry products. By applying this technique we identified the various systematic area for making a limited collection. Some systematic area are: study of core journal, ranking of authors, authorship patterns (Single multiple authorship), ranking list of institution, citeted year of literature, productive year of literature. Language distribution geographical distribution etc. These all systematic area has a more significant value in literature and a large collection can be done limited.

The Limited collection has more use to compare unlimited collection. A research scholar can search and fulfil his need in minimum possible time. And another side information manager can classify to the core limited collection in minimum possible time.

So here can say that in this case a bibliometric analysis is very useful for information manager to select a very useful collection and odering of the collection. Here in this case SDI (Selective Dissemination of Information service and Bibliometric analysis are equal because S.D.I. service and Bibliometric analysis are providing selective information to user.

The technique of bibliometric analysis has used in the literature on Pines during the period 1994 to 98. by the bibliometric analysis here of analysed various systematic areas which is very useful to select the information for user as well as Information Managers. From a large collection.

CHAPTER-1

BIBLIOMETRICS

"BIBLIOMETRICS"

1. INTRODUCTION

Bibliometrics is of recent origin and relatively a new development. Bibliometrics is that branch of information science which lies between the border areas of the social and physical sciences. Bibliometrics is a systematic and quantitative study of various phenomena of literature on a particular topic and by the use of bibliometrics study help to identify the various peculiarities of publication, authorship, bibliographic control, values of literature, citation and secondary journal coverage with the objective of getting an insight into the dynamics of the exposion of knowledge. Bibliometrics is a systematic formula of literature study, by the help of bibliometrics study, any type of literature can be searched in minimum possible time. Today, increase in the number of publications may have been due to the use of bibliometric techniques in various disciplines and to the greater interest in the theory of literature structure. This consequently leads to better all organization of information resources which is essential for more effective and better use.

Bibliometrics today has became sophisticated and complex and has national, international & interdisciplinary quality. *A Lawani* says,-"Bibliometrics has clearly become established as a sub discipline with application in the history and sociology of knowledge in communication and information science".

2. ORIGIN OF BIBLIOMETRICS- "HISTORY"

The British Librarian, *Alan Pritchard* was credited with introducing the term "Bibliometrics in 1969 to replaces the term" statistical bibliography". Its usage can be traced back to the second decade of this century, a pioneer and good example is of a bibliometrics study conducted by *Cole* and *Eales* in 1917. They conducted a statistical analysis of the literature of comparative anatomy from 1543 to 1860 by counting the number of titles from both books and articles, and grouping them by countries of origin with periods. *Hulme* was the first to use the expression term 'statistical bibliography' in 1923 and later this term was used by many persons. *Gross* and *Gross*[5] study is consider to be the third study in the field based on citations. After Hulme, the statistical bibliography was used by *Henkle* in 1930 in his article "The periodical Literature of Biochemistry" and *Gosnell* in his dissertation in 1943, and later in his article

of 1944. *Later Fusseler* in 1948 and 1949. *Raising* in 1962, *Baker* in 1966 and *Pritchard* in 1948 and 1969 have used the term 'statistical Bibliography in their works.

The most prominent was of *Bradford* in 1934 on the distribution of papers among Journals in applied Geophysis and in lubrication Research. It formed the backbone of the theoretical foundation of the bibliometrics study, known as the "Bradford's law of scattering".

3. OTHER ANALOGOUS TERMS

Many scientists have used the term under different names like 'Librametrics' 'scientometrics' an 'informatrics' are also use in the literature.

Bibliometrics is analogous to Ranganathan 'Librametrics' in 1948. Russian concepts 'Scientometrics'. FID's Informetrics and some other well established sub-disciplines like 'Econometrics', Psychometrics', Sociometrics, biometrics'. 'Technometrics', Chemometrics', 'Cliometrics', where mathematical and statistical calculus have been systematically applied to study and solve problems in their respective fields. In modern times the term scientometrics is used for the application of quantitative methods to the history of science and obviously overlaps with bibliometrics

to a considerable extent. *Kopeloeck* points out during the period 1969-1977, altogether 52 different terms have been coined to design bibliometrics.

4. DEFINITION OF BIBLIOMETRICS

The word 'BIBLIOMETRICS' is the combination of two words. (1) biblio, and (ii) Metrics. The word Biblio is derived from the combination of a Latin and Greek word biblion, meaning book, paper. On other hand the word metrics indicates the science of metre i.e. measurement and this word also derived from Greek and Latin word metrics or Metrikes each meaning measurement.

4.1 According to *Pritchard* bibliometrics defined as "*The application of mathematic and satistical methods to books and other media of communication.*"

4.2 According to *Potter.* He defined bibliometrics as '*The study and measurement of the publication patterns of all forms of written communication and their authorship*"

4.3 *Schradar* said it even more simply bibliometrics is "*The scientific study of recorded discourse*".

4.4 *Raising* Defined it 1962 as "*The assembling and intepretation of statistics relating to books and journals*". Raising's definition is regarded as one of the classical definition of bibliometrics

4.5 According to *Hawkins* "*The qualitative analysis of the bibliographic features of a body of literature*".

4.6 The British standard *Glossany* of documentation of terms "*The use of documents and patterns of publication in which mathematical and statistical methods have been applied*".

4.7 *Fairthorne* defined bibliometrics as, "*The quantitative treatment of the properties of recorded discourse and behaviour pertaining to it*".

4.8 *Nicholas* and *Ritchie* defined "*Bibliometrics provide information about the structure of knowledge and how it is communicated.*" They further added that "Bibliometric studies fall mainly into two broad categories-those describing the characteristics of features of a literature (descriptive studies) and those examining the relationship formed between components of a literature (behavioral studies).

These definitions show that bibliometrics aims at the examination of the statistical distribution of the processes relating to:

(i) The utilization of documents

(ii) Library staff and

(iii) Library users

It helps to evaluate 'information processes and information handling in libraries and information centres.

5. BIBLIOMETRICS: SCOPE AND PURPOSE

Bibliometric studies are generally based on quantitative measurements without any qualitative evaluation. They are, therefore, considered only as partial indicators of scientific progress.

1. It sheds light on the process of written communication and on the nature and course of development by a descriptive means of counting and analyzing the various facts of written communication.

2. It provides information about the structure of knowledge and how it is communicated.

3. The scope of bibliometrics includes studying the relationship within a literature (citation studies) or describing a literature. Typically, these descriptions focus on consistent patterns, involving authors, monographs, journals or subject/languages.

4. It is a quantitative science and it is divided into two basic categories.

(i) descriptive bibliometrics productivity count

(i) geographic,

(ii) time period and

(iii) disciplines

(ii) evaluative bibliometrics (literature usage count)

OR

(i) reference count and

(ii) citation count

The descriptive bibliometrics further includes 'the study of the number of publications in a given field or productivity of literature in the field for the purpose of comparing the amount of production during different periods, or the amount produced in a count of the papers, books and other writings in the field or often by a count of these writings which have been abstracted in a specialized abstracting journals.

Evaluative bibliometrics includes the study of literature used by research worker in a given field. Such a study is often made by counting the references cited by a large number of research workers in their papers.

6. BIBLIOMETRICS LAWS

The three fundamental laws as are statistical expressions which seek to describe the working of sciences

by mathematical means. The three basic Laws which lead the formation of biblometrics are:-

6.1 LOTKA'S INVERSE SQUARE LAW OF SCIENTIFIC PRODUCTIVITY (1926)

6.2 ZIPF'S LAW OF LINGUISTICS OR WORD OCCURANCE (1933)

6.3 BRADFORD'S 'LAW OF SCATTERING (1934)

6.1 LOTKA'S INVERSE SQUARE LAW OF SCIENTIFIC PRODUCTIVITY

Alfred J. Lotka proposed his inverse square law correlating contributors of scientific papers to their number of contribution in 1926. His law provided fundamental theoretical base for bibliomatric studies involving authorship. He claims that a large proportion of the literature is produced by a small number of authors and it is distributed so as the number of people producing n papers is approximately proportional to $1/n^2$.

He was interested in determining "the part which men of different calibre, contribute to the progress of science for this he checked the decinnial index of chemical abstractions 1907-1915 and counted the number of names against which appeared 1,2,3, etc. entries, he tabulated the data for 6, 891 names, beginning with letter A and B similarly the data from the Auerbach's Geschietftafelhder physic was also collected for the 1325 physicists. Lotka then

plotted the graph on a logarithm scale, the number of authors against the number of contributions made by each author and he found that in each cae the points were closely scattered about a straight line, having a slope of approximately two one. On the basis of this data Lotka deduced a general equation, for the relation between the frequency 'Y' of Persons making 'X' contributions as follows.

$X^n . Y$ = constant

and for special case n=2, the constant is 0.6079

Further he summarised the results as follows

"In the case examined it is found that the number of Persons making 2 contributions is about one fourth of those making one contribution, the number making 'n' contributions is about $1/n^2$ of those making one and the proportion of all contributions is about 60 percent.

So, we say there are 100 authors making one contribution each there would be

100/2 = 25 authors making 2 contributions each

100/32 = 11 authors making 3 contributions each

100/42 = 6 authors making 4 contributions each

6.2 ZIPF'S LAW OF WORD OCCURRENCE

Zipf's law is different from first law *Zipf* developed and extended an empirical law, as observed by Estop, governing a relation between the rank of a word and frequency of its occurrence in a long text. If 'r' is the rank of a word and 'f' is the frequency of its. Then mathematically Zipf's law can be stated as follows:

$r \propto 1/f$

$f \propto 1/r$

fr = constant

Zipf law states that in a long textual matter if words are arranged in their decreasing order of frequency then the rank of any given word of the text will be inversely proportional to the frequency occurance of the word.

Example - Any textual certain word are prepared

Word	**rank(r)**	**Frequency(f)**	**Fxr**
The	1	245	245
of	2	136	272
Term	3	98	254
to	4	81	324
a	5	65	325

6.3 BRADFORD'S LAW OF SCATTERING

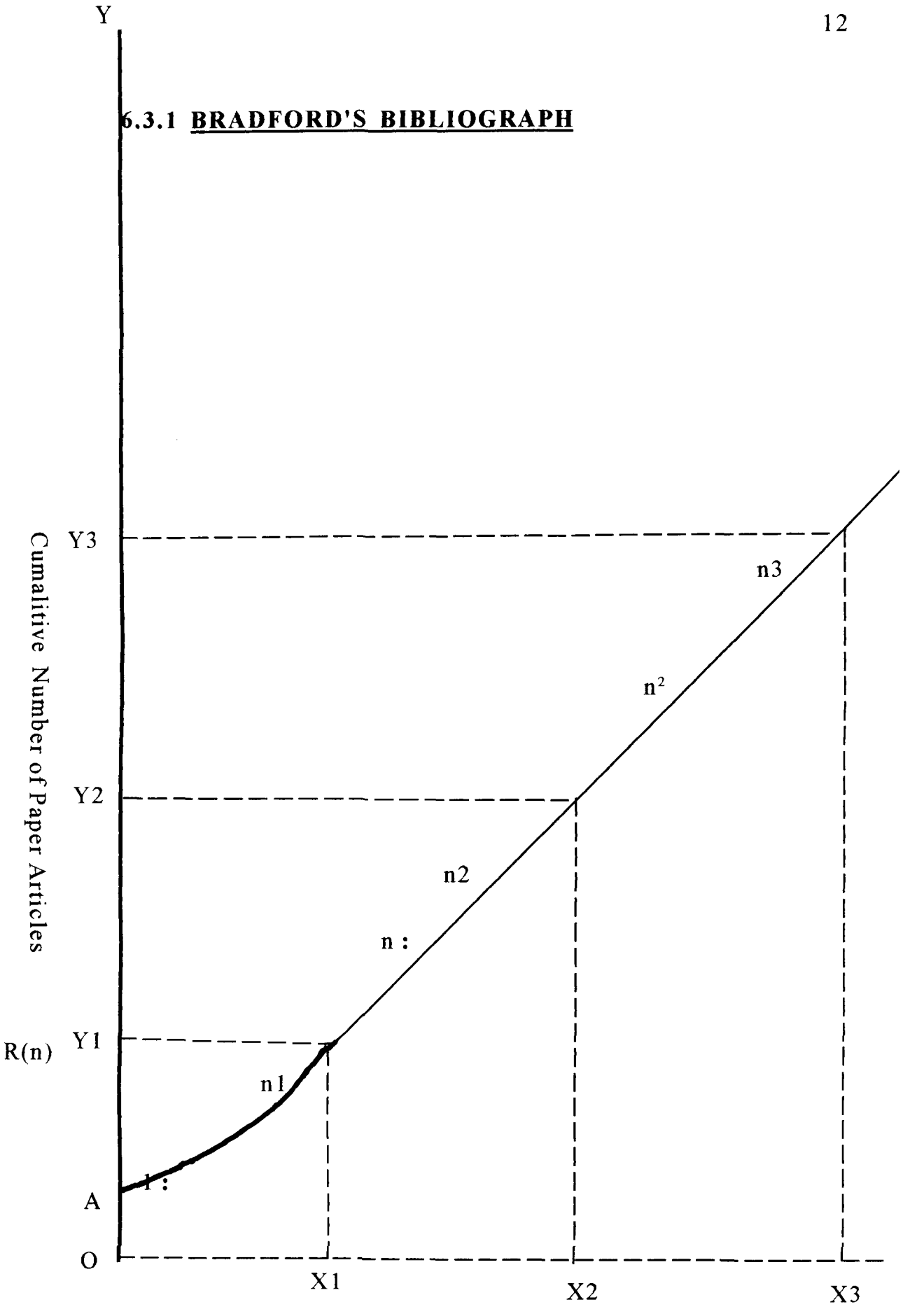
Brad ford's law is considered or perhaps the best known of all the bibliometrics concepts.

Samuel C. Bradford first formulated his law in 1934 but it did not receive wide attention until the publication of his book 'Documentation' in 1948. He, while searching for papers in Applied Geophysics and on Lubrication, noticed that the scatter of such papers among the scientific journals had a common pattern. He described it as - "If a large collection of scientific journals are arranged in order of decreasing productivity of papers relevant to a given subject, then they may be divided into clear three zones so that each zone produces 1/3 of the total relevant papers. The first, the nucleus zone, contains a small number of highly productive journals, say n1; the second zone contains a larger number of moderately productive journals, say n2; and the outer zone containing a still larger number of journals of low productivity say n3. He enunciated his law of scatter as:

$$1 : n : n^2$$

This is known as the Bradferd's equation

6.3.1 BRADFORD'S BIBLIOGRAPH



Log (n) Cumalitive Number of Journals

For the data which Bradford analysed, the value of was found to be about 5.0 So that a typical collection of 248 journals might ideally be divided into a nuclear zone of 8 highly productive journals, a second zone of 5x8 or 40 journals of moderate productivity and a third zone of 5^2 x 8 or 200 journals of law productivity.

A physical analogy of the situation may be that of the comet, with the nucleus representing the core journals of a discipline and the debris and the gas molecules of the tail representing additional journals that also publish sometimes materials relevant to the subject. As subjects or disciplines get larger, the pursuit of complete coverage becomes difficult. Thus, to cover all of chemistry, CA claims to scan over 10,000 journals; where as a large percentage of its coverage is derived from only 1000 periodicals.

Bibliographic studies in a number of fields confirm the dispersion of articles throughout a set of journal titles conforms to a statistical distribution of the type described by Bradford. But arriving at a precise

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Bibliographic studies in a number of fields confirm the dispersion of articles throughout a set of journal titles conforms to a statistical distribution of the type described by Bradford. But arriving at a precise mathematical expression proved to be a matter of controversy. The simplest graphical representation of this law is obtain by plotting cumulative total of relevant papers R(n) on a log scale.

6.3.2 APPLICATIONS OF BRADFORD'S LAW

Bradford's law has been shown to be applicable to bibliographies as well as to larger aggregates of literature. A study of the distribution of monographic literature issued by publishers has shown that Bradford's law can be applied to predict the productivity of publishers of monographs. Patterns in the actual use of documents in libraries have also been found to obey the law of scattering.

Bradford's law has been applied to studies of dispersion of literature, mostly in the fields of science, engineering and medicine. Most of these are 'citation studies' which consist of ranking journal titles in published literature. Ranked lists of journals may also be developed on the basis of actual use of the journals as revealed by circulation statistics or direct observation in libraries.

Ranked list of journals can be used as a tool in the development and management of journal collections in libraries. Studies on the scattering of literature enable designers and managers of libraries and information centres to ensure the following types of questions:

1. What would be the cost of collecting all the journals relevant to a given topic:

2. What fraction of the total coverage would be available at any specified limit of cost?

3. What is the optimum distribution of journal collections as between a central reference point and satellite developmental or regional collections?

4. How can be given collection best be subdivided into collection of primary, secondary and tertiary relevance or into stores requiring frequent/occasional or only rare access?

7. SOME OTHER EMPIRICAL LAWS ARE:

(i) Price Square root Law of Scientific Productivity

(ii) Garfield's law of concentration

(iii) Sengupta's law of bibliometrics

(i) Price's Square root Law of scientific productivity

This law states that "half of the scientific papers are contributed by the square root of the total number of scientific authors. In other words, $N^{1/2}$ sources yield a fraction 1/2 of the items. This phenomenon is associated with the occurrence of invisible colleges. This law is sometimes called 'Rousseau's law' since Jean Jacques *Rousseau* has mentioned the same thin quite clearly in his 'Social Contract' about the size of the elite, i.e, those

participating in the government. *Egghe* and *Rousseau* argue that Price's law is not generally valid. This can also be treated as an extension of the success-breeds-success principle originally developed by *Simon* in 1955.

ii Garfield's Law of Concentration

Garfield talked about the number of journals involved in publishing the literature of a single field. He did not say anything about how much the journals in one field might overlap with other fields. In fact, there is a significant degree of overlap. Several studies have shown that relatively few journals are involved in the publishing of an overwhelming majority of the material in a subject. A study of the Science Citation Index (SCI) database showed that 500 journals accounted for 70% of the material indexed in SCI in 1969. Almost half of the 3.85 million references published that year was found to emanate from only 250 journals. This type of evidence makes it possible to move from Bradford's law of dispersion to Garfield's law of concentration.

The law states that "a basic concentration of journals is the common core or nucleus of all fields. In other words, the tail of the literature of one discipline consists, in a large part, of the cores of the literature of

other disciplines. So large is the overlap among disciplines that the core literature of all scientific disciplines involves a group of not more than 1000 journals.

(iii) Sengupta's Law of Bibliometrics

This is basically an extension of the Bradford's law. It states that "during phases of rapid growth of knowledge in a scientific discipline, articles of interest to that discipline appear in increasing number of periodicals distant from that field" Mathematically Sengupta's law stands in the following form

$$f(x+y) = a+b \log (x+y)$$

where f(x+y) is the cumulative number of reference as contained in the first (x+y) most productive journals, x indicate number of journals in the same discipline and y stands for number of journals of unrelated disciplines (y>x) and a and b are two constants.

Ravichandra Rao summarizes other empirical laws in one of his papers and those who are interested can go through the reference. He has also listed more important bibliometric models.

8 APPLICATION OF BIBLIOMETRICS

Now in Modern time bibliomatric techniques are being applied to got factual and accurate data in the transfer and handling of information. Generally there are some application of bibliometrics are follows.

8.1 To find out form of document:- In bibliometrics study many slips or card of references were sorted in to different categories on the basis of document form cited. They were grouped into journals articles, Books, proceedings, serials, thesis papers, report and others like bulletins, symposium etc.

Example:- some scientists taken out some papers and cited many different form material or document. This table shows the different cited form of documents

CITED FORM OF DOCUMENTS OF BIBLIOMETRIC STUDY ON TUBER CROPS

Type of Document	Cited form of documents	Percentage
Journal articles	692	62.51
Books	149	13.46
Proceedings	120	4.87
reports	54	4.87
Bulletins	32	2.90
Serials	26	2.35
Thesis	22	1.99
Others	12	1.08
	1107	**100%**

8.2 Geographical scatting of item:- Bibliometrics study shows the geographical distribution according to countries and name of institutions.

8.3 Chronological study can be done

8.4 Language distribution:- By the help of Bibliometrics study the languages of documents can be distributed.

Example :- 100% literature on Pine plants found in various languages in five year study.

Language	**Percentage%**
English	80%
Chinese	7.64%
Korean	2.71%
Russian	2.51%
French	2.51%
German	1.06%
Bulgarian	0.96%
Others	1.83%
	100%

8.5 Ranking of Periodical:- Bibliometrics helping to know about the core journals by help of Bredford's law.

$1:n:n^2$

8.6 Bibliomatric gives the specific ranking of authors.

8.7 Subject Discipilnary:- Biblimetrics study help to know the strength of subject and interdisciplinary nature of subject or studies.

8.8 Bibliometrics help in bibliographic control.

8.9 Bibliometrics help in inter library loan service

8.10 Bibliometrics tells about known and unknown documents

8.11 Bibliometrics study provide yearwise distribution of publications

8.12 To identify research trends and growth of knowledge

8.13 To estimate comprehensiveness of secondary periodicals

8.14 Bibliometrics adopted an accurate weeding and staching policy

9. BIBLOMETRIC MEASUREMENTS

Bibliometrics measurements based on the concept of Biblimeteics so the bibliometrics measurement derived from the concepts of citation indexing and it was based on the English legal system, which operates under the doctrine of stare oleisis precedent, on the basis of which *Garfield* developed science citation index, Arts and Humanities Citation Index and social science citation index. (1966).

9.1. Direct Citation Counting

Citation counting is a systematic technique that is determines how many citations a given document, author, journal, year, etc. This used originally by *Gross & Gross*. The relation for this is that citations are objective indicators of use and therefore an article, author, journal that is frequently cited, is more useful or productive, as the case may be, than one that is less frequently cited. In order to offset the limitations of citatioin counting some modified measures have been suggested The 'Impact factor' and 'Immediacy Index' are two such measures. The term impart factor coined by Garfield and he defined it as "the nation of the number of times published in the journal, during specified period of time. The impact factor is measure of the frequency which the average cited article in a journal has been cited particular year. It cited the core literature of the given discipline.

9.2 Bibliographic Coupling

Bibliographic coupling also a citation. The concepts of bibliographic coupling was first suggested the scientists *Fano* but *Kessler* elaborated, tested and coined th term. In it the number of common references cited in two document that indicates the degree of similarity of contents of the citing

papers. Two source of documents containing a large number of common references are said to have a high coupling strength and are likely to be on the same topic.

It is observed that the concept of relationship has certain drawback and not seem to be a valid unit of measurement because it two paper are citing a third paper, they may or may not be citing and identified piece of information of third paper being cited.

9.3 Co-citation

The concept of cocitation was for the first time suggested independently by *Small* and *Marsakora* almost simultaneously in 1973 and later developed by *Small.* Who proposed a new method of analyzing citations to generate clusters of related papers. The number of time two paper cited together in the subsequence literature, determines the co-citation strength of two cited papers By the co-citation process the comprehensive data can be collected from the large amount of literature.

10. CITATION ANALYSIS

The primary function of citation is to provide "a connection between two documents, one which cites and the other which is cited.. The first recorded citation analysis

was a study by *P.LK. Gross* and *E.M. Gross* published in 1927 in order to determine the journals to be subscribed to and the back volumes to be acquired for the Library of the Pomona College. They studied the citation frequency in the references given in the *Journal of the American Chemical Society*. Citation analysis is very often fruitfully applied to derive the following benefits.

10.1 To lead the reader to further studies in the field.

10.2 For the preparation of bibliographies.

10.3 To study the use pattern of different types of documents.

10.4 To find out the relative use of different languages.

10.5 To study the use of literature from different countries.

10.6 To study the scattering of subjects.

10.7 To decide the obsolescence rate of documents in different subjects.

10.8 To determine the interdependence and lineage of subjects.

10.9 To prepare ranked list of periodicals.

10.10 To study the rate of collaborative research.

10.11 For the analysis of scientific journals.

i) citation rate of journals

ii) impact factor

iii) self-citing rate

iv) self cited rates

v) immediacy index

11. CONCLUSION

Bibliometrics studies is the kee for the theoretical literature because it have enabled to develop a body of theoretical knowledge and a group of techniques and have facilitated its application for the further growth of knowledge based on bibliographical data. Bibliometrics studies analysis structure contain or prepared by three various laws which are helped to contain various records. For literature search. The literature search further analysis in the contents science citation index by using *impact factor* etc. It is the further techniques of bibliometrics studies, By citation analysis. we can cited the different concept of literature like journal authors co-citation and cited year etc. So at last we can say that the Bibliometrics studies gives particular view for the literature studies and technical search for literature. A major portion of these studies pertains to the application of bibliometric laws and models. However, there is a long way to go in achieving perfection in the studies. Even the widespread use of computers for retrieval, countig and analysis are unlikely to achieve perfection in the studies. The changes that are frequently occurring in the publication practices are likely to complicate the studies in future. In such circumstances, it is advisable to consider the results of such studies as more guidelines rather than ends in themselves.

CHAPTER-II

AN INTRODUCTION TO PINES

A PORTION OF PINE TREE WITH VARIOUS ELEMENTS

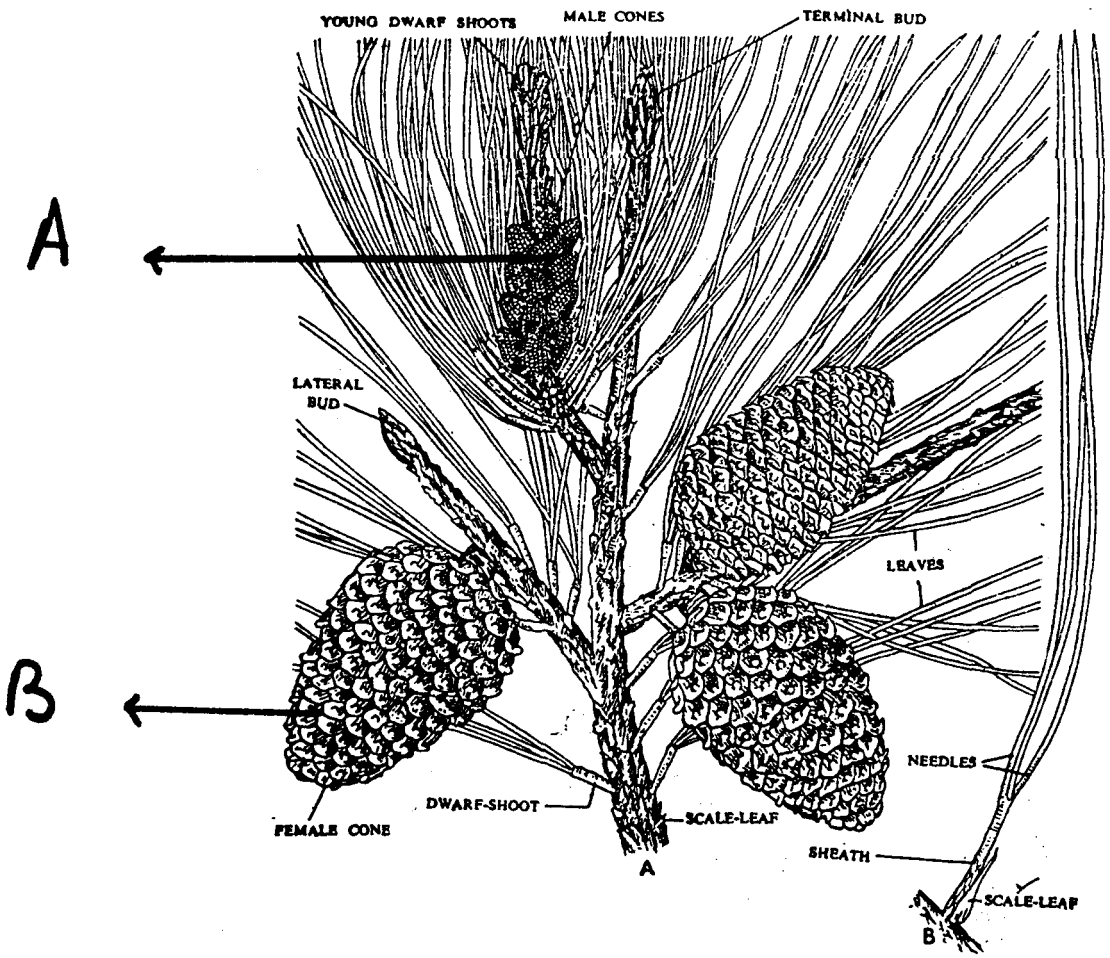


Fig. 1. Habit of *Pinus*. *A*, A portion of tree. *B*, a dwarf shoot

A → MALE CONES

B → FEMALE CONES

"PINE PLANTS"

0. CLASSIFICATIOIN

Kingdom	:	*Plantae*
Sub-Kingdom	:	*Embryophyta*
Phylum	:	*Tracheophyta*
Subphylum	:	*Pteropsida*
Class	:	*Gymnosperme*
SubClass	:	*Coniferophytae*
Order	:	*Coniferales*
Family	:	*Abietaceae*
Genus	:	*Pinus*

1. GEMNOSPERMS

The gymnosperms although a diverse class with possibly more than one origin from the carlist land plants, are with few exceptions archegoniate and almost entirely arborescent. Their fossil record rivals that of the ferns, pines in richness and variety.

Sporophyte usually arborescent; branching and leaves various. Secondary vascular tissue always present, sporangia borne on specialized structures, probably of oxide origin. Heterospony general. The megasporangium enclosed within a specialized sheath, perforated at the opex by a

narrow channel (Micropyle), the whole termed the ovule, neither male nor female gametophytes out tropic. Fertilization by multiflagellate antherozoids or by male cells with no specialized means of Locomotion, occurring within the ovule, either before or after its being shed. Embnyogeny endoscopis the embryo remaining contained within the seed developed from the ovule.

2. CONIFERALES

The conifers are the most widespread of all the groups gymnosperms and they form the climax vegetation at high altitudes and in the older regions of the temperate zones, particularly the north. They are much less common in the tropics, and here they are usually confined to mountains and one often mixed with angiospermous trees of all the vascular plants discussed so far the coniferes are the first of significant economic importance. They are almost all arborescent and the wood is used extensively as timber Pinus and as a source of pulp for paper making and related industries.

3. PINUS

Pinus plant is a evergreen plant. Pinus always found in hill area and tropical, sea area, and many different species are now available in the world and these various

species of Pinus trees having various economic importance. The Pines have been traced back in geological history to the Jurassic period (150 Million) years though they reached their climax of distribution only in the Tertiary (60 million years). By the lower getaceous (125 million years) two distinct groups emerged

(i) Haploxylon or Soft pines

(ii) Diploxylon or hard pines.

The plant of Pines exhibit an exceptionally long life in the Inyo National forests of California. USA, there is a tree of Pinus anistata which is morethan 625 years old, still producing cones occasionally.

The Pinus plant have a very strong life cycle and strong classification. Pinus belong to the family Pinaceae or Abietaceae of the order coniferales. The other genera included in this family are *Abies Mill.*, *Cathouya* Chun and *Kuang Cednus link.*, *Ketelieria Carr.*, *Larix Mill.*, *Picea Az. Dietir.*, *Pseudolarix Gord.*, *pseudotsuga carr.*, and *Tsuga carr.*

Some of the characteristic features of the family are as follows: the plants are Monoecious, the microsporophylls are spirally arranged with two abaxial sporangia per sporophyll; female cones with numerous spinally arranged pairs of scales. Seed scale complex viz. ovaliferous scales

and the bract scales the former free from the latter or only slightly fused at the base: ovules adaxial with micropyles directed towards cone-axis; and seeds generally winged.

4. DISTRIBUTION OF PINUS

Pinus species distributed according to geographical area in the world about 110 species of Pinus available in the all world. Dallimore and Jackson (1966) ever Mention (80 valid species. It is found mainly central America, Bahamas, British Honduras, the subtropics of north Africa, the Charry Islands, Afghanistan, Pakistan, India, Burma and the Phillippines crossing the equator in Indonesia. In the tropical country like India, It is found in the hills with subtropical or temperate climates, though some pines are grown as ornamentals even at lower altitudes.

4.1 Pinus Distribution in India

In the Indian subcontinent there are six species of Pinus of which four one distributed in the Himalayas. They are *P. roxburghiisarg*, *P. wallichiana* A.B Jacks; *P. insularis* Endl and *P. gerardinana* wall. ex Lamb. A few trees of *P. armandii* Franch. Occur in the North East Forntier Agency NEFA (Kingdom Word 1952). *P. merkusii* jugh and de vriesegrows on the hills of varies considerably.

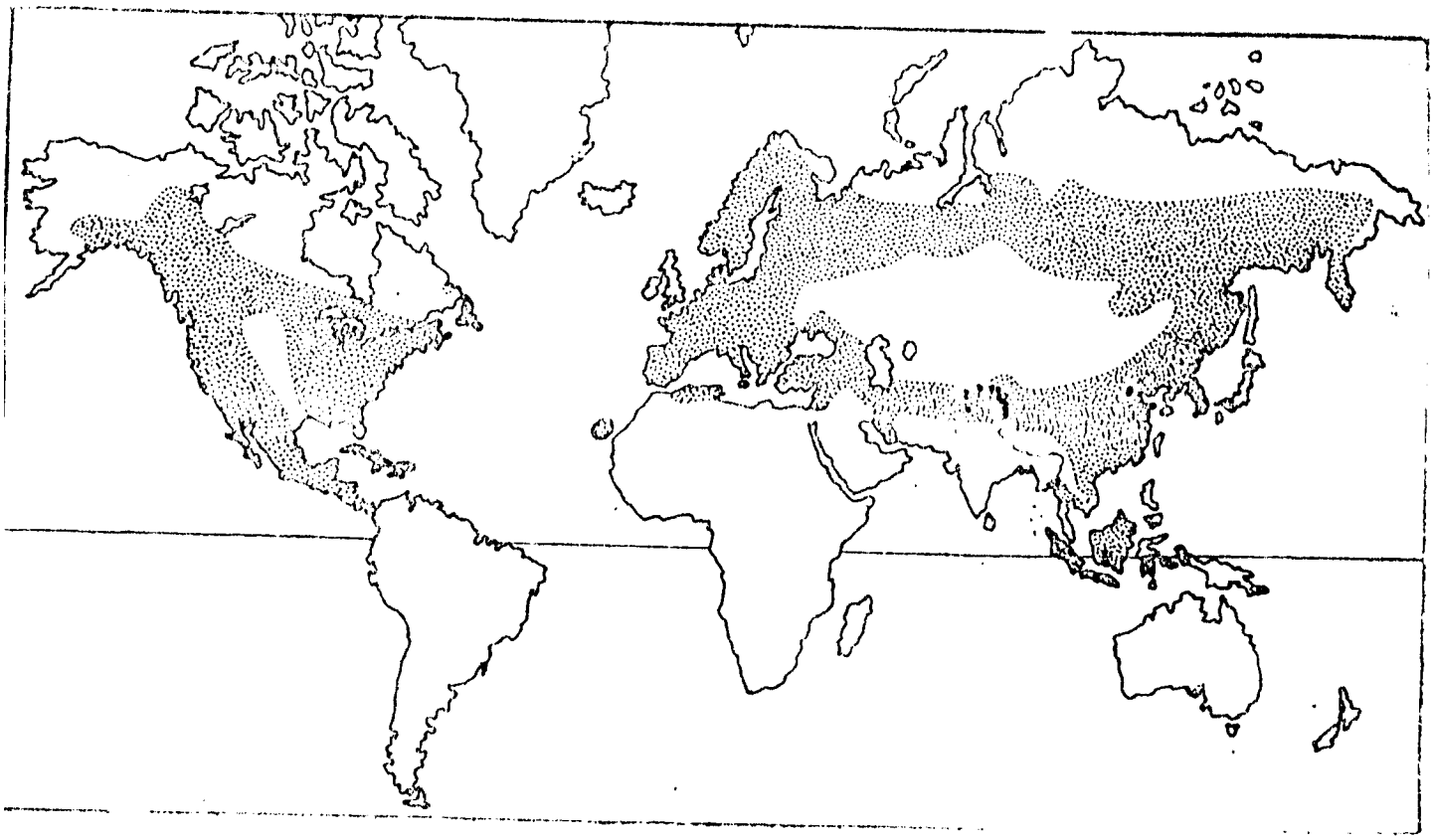


Fig- 2 Geographical Distribution of Pines in the World

Apart from indigenous species, some exotic species also occur. These are listed below along with the areas where they were successfully planted (With India-Raw Materials, VIII).

4.1.1 Species Area where Occur (Indian Species of Pines)

P. Lanarieniss C. Smith Srinagar (Kashmir)

P. Caribaea Morelet Assam: Dehradun (U.P.)

P. Cembroides Zucc edulis *Vass* Nilgiris(S. India)

P. Halepensis Mill Srinagar

P. Massoniana Lamb. Kulu Manali (H.P.) Raman (West Bengal)

P. Nigra Arn. Var Colabnica Schneid syn. Plarico Poir. Kulu Manali Natihat Plateau, Palama

P. Pinester Ait. Kulu, Manali, Rahini

P. Radiata D. Don Nilgiris

P. Subiniana Dougl Milgiris

P. Taeda L. Kulu Manali Rahini

P. thunbergii Parl. Samunder,Takedah (West Bengal)

5. MORPHOLOGY OF PINUS PLANTS

In their general habit, young pine trees are pyramidal with their horizontal branches dispossed in regular whorls. As the tree matures, this symmetry is lost and the crown becames rounded, flat, or even-spreading Under cultivation, when planted close, the trees lose their banches, and thus have a considerably long bole.

The stem bears two types of branches:

(i) Branches of unlimited growth or long shoots

(ii) Branches of limited growth or dwarf shoots

The long shoots appear on the main stem as lateral buds in the axils of seed leaves. Each of these shoots terminates in a apical bud, which is enclosed by a number of bud scales closely surrounded by a thick mat of hairs. The lateral buds grow more or less horizontally to a certain length, and this growth has been turned modal growth. In some pines this growth is restricted to the production of a single internode every year (Uninodal pines), but in some others there may be two several internodes per year.

The dwarf shoots or foliar spurs develop on the long shoots, arising in the axils of scale leaves, each dwarf shoot initially has two opposite scales, termed prophylls followed by 5-13 spirally arranged scaly cataphylls. These

are in 215 phyllotax. Finally depending upon the species, 1-5 needle like leaves develop. Unlike the long shot the dwarf shoot lacks a terminal bud. The leaves are of two kinds.

(i) The foliage leaves which appear only on the foliar spurs, and

(ii) The scale leaves, which are developed as protective structures.

The male and female cones are born on the same tree, though on different branches, they become visible towards the end of spring or the beginning of summer. The male cone (the modified dwarf shoots) appear in clusters (catkin) on the lower branches of the tree, whereas the female cones, which replace the terminal buds of the longshoots are the modified long shoots in most of the species, including *Pinus roxburghii* and *Pinus Wallichiana*, the mature female cones open and release the seeds, but in others the seeds are released only after the cones fall to the ground and rot. In a few species such as *P. flexilis*, the cones remain on the tree for several years and open only when they are scorched by forest fire.

The Pines are generally light demanders; a few can tolerate partial shade for several years, but their growth is stunt. They do not thrive in areas which remain hot and

humid throughout the year. Only a few seasons-dry and wet, and warm and cold or often a combination of both is required for the normal development of pines.

There are several external characters which facilitate the *identification* of different pines. The number of needles per dwarf. Shoot, their length the position of the umboo on the apophysist, and the shape, size and colur of the resting bud are some of the important ones.

6 KEY TO THE IDENTIFICATION OF INDIAN SPECIES

A. Leaves in Fives

B. Seeds winged

C. Young Shoots glaucous green. Winter bud cyclindric conic, 0.6-1.2 cm long leaves 12.5-20 cm. long. cones nannocoly cylindrie, 15-30 cm long; scales rounded at the apex, a few at the base may be reflexed

P.wallichiana

BB. Seeds Wingless

C. Young shoots olive-green bearing minute pellucid glands. Winter buds cylindric, slightly resinous, leaves 10-15 cm long, sharply bent near the base. Cones broadly cylindric, 10-18 cm. x 5-9 cm; scales thick, rigid. Margins slightly reflexed. *P. armandii*

AA. Leaves in Threes

B. Seeds Winged, leaf sheath persistent leaves usually 18-30 cm long

C. Young shoots glabrous, light brown slinder. Witer buds with slales free at tips. Leaves very slender, grassygree, 12.5-22-0 cm long cones ovoid symmetrical, 5-8 cm long P. insukaris.

CC. Young shoots grey or pale brown winter buds ovoid, non-resinous. Leaves light green, slinder, 22-32 cm. long cones 11-20 cm x 7-9 cm; scales hard, thick apex reflexed P. roxburghii

BB. Seeds with rudimentary wings, leaf sheath non persistent, leaves 5-10 cm long

C Young shoots olive green, leaves slinder. dark green, 5-10 cm long cones oblong ovoid 15-20 cm x 10 cm; scales thick woody exposed part triangular and reflexed, ending in a recurved spine *P.geradiana*

AAA. Leaves In twos

Young shoots glabrous, leaves 17.5-25.0 cm long Persisting apex abruptly pointed. Cones cylindric. 5.0-75 cm long seeds winged *P.merkusii*

P. wallichina, the blue or Bhutan pine commonly known in trade as kovil, is found in the Himalayas from Kshmir to Bhutan at attitudes of 1,500-3,000 m. It is very commonly found in western Himalayas in Kashmir valley Simla, Chakrata and Mussoorie and in the eastern Nepal at altitudes of 1,500-2,135 m. In Bhutan it occurs along the valley above the river Tista (lower ranger valley). Though this species is sporadically distributed along the eastern part of the kameng division of NEFA. It is most dominant in the Khalaktang area, Rupa valley and the dirang Dzong valley at an altitude of 1,500 m. coving an extensive area along the hill slopes.

The species is found on a variety of geological formations, growing best on well drained moist soil with an annual rainfall of 100-200 cm. some of the best forest are found on the *Mica schist* which breaks down into ideal soil.

The blue pine is the woody tree blue pine tree are 30-90 m height, with horizontally spreading branches.

P.armandii:- Franch, in Nouv. Arch. Mus. Hist. Niat. Paris ser. 2-7: 95 to. 12 (Pi. Edinh 27:49 1916

Kingdom-Ward (1952) reported the occurrence of this species in the NEFA area. The tree of this species attains a height of 18 m and a diameter of one meter and the winter buds are cylindrical, blunt and slightly resinous. The

needles are to 15 cm long. The female cones are subterminal in groups of 2-3 cone in 2-3 cm, or more long, broadly tapering into rounded epex. The wingless seeds are 1.3-1.6 cm long and are liberated soon after they nipen.

P. insulanis:- Endl Syn. coniff. 158, 1847; P. Kasya royle ex Parel. in Dc. Prodr. 16, 2: 39 0.1868 For. FL. 2: 499 1877; *P. Khasyana Griff.* Natul. PL. As. 4: 18. 1854; *P. Khasya Hook.* f. FB 15: 652 1888.

The taxonomic status of *P. insulanis* and *P. kesiya Gord.* is not satisfactory settled, there is a strong possibility that these two names contain same species.

The tree is 60-90 m in height and trunk up to 6 m in diameter. The bark is thick, reddish grey and deeply fissured giving a retieulote appearance. The branches are arranged in whorls forming a rounded crown. The leaves are in fascicles of threes and are 15-25 cm long slinder with acute apices. The old needles fall for the most part during April May though the scale leaves are persistent.

The male cone and female cones appear on the new shoots during February-March. The mature male cones are light brown and 3.5 cm in diameter. The female cones are approximately 5.0-7.5 cm. long and 4.6 cm in diameter and

are the smallest amongst the Indian pines. The seeds have long wings which are about four times the length of the seed.

The plants come up naturally in places of abandoned or shifting cultivation, or in areas where undergrowth of forests has been burnt for artificial height.

P. roxburghii:- Sarg in Silva N. Am. 11:9. 1897; *P. Longifolia Roxb.*, F1, Ind. 3:651 1832, non salish. Prodr. 398, 1796: Hook P. FBI 5: 652, 1888.

In all the Indian pines, this is the most important and is known as the Himalayan long leaved pine or chir pine. It is peculiar to the main valleys of the western Himalayas at altitudes of 460-1,500 m, and extends into Bhutan. Along the eastern Nepal this species is restricted to lower elevations in NEFA, along the Kameng Frontier Division, it appears to be very sparsely distributed among the pure and extensive formations of *P.xallichiana.* It is large evergreen tree with a spreading crowns the young shoots are very to pale brown and the winter buds are avoid and non resinous. Leaves 15-40 cm long there on a dwarf shoot.

Natural regeneration is normally through seeds. Mature cones are collected from healthy trees for artificial regeneration, placed in hot sun to loosen the scales and then the seeds thrashed. This is normally practised where

conidiophores forests have been damaged by fire and is mostly done by direct sowing

P. Gerardiana:- Wall. ex Lamb. Deser. Gen. Pinus, ed. 3. to. 79, 1832; Royle 111, 353: to. 85. 1839; Enal. Syn conif. 159-1847: Parl. In DC. Prodr. 16.2: 390, 1868: Brand. for. Fl. 508 to. 67. 1974: Hook. f. FBI 5: 652. 1888.

This species is most useful and this is provided a most effective seed which is use for food.

Pinus gerardiana wall known as chilgoza this is an edible pine nut of North western Himalayas. In India its natural plantations are found in inner Himalayan zone comprising Kinnaur and pangin Himachal Pradesh and Kistwar and Astur areas of Jammu and Kashmir, Pakistan and the Tibet borders. The total chilgoza nuts production in the country, kinnaur exports about 2000 quiantls of edible nut annually.

The plant is an evergreen tree 18 m or more in height and 1.8-2.4 m diameter. It grows on dry, rocky grounds at an elevation of 1,830-3,600 m.

P. merkusii:- Fungh. & de Vriese in Pt. Nov. Ind. Bat. or. s: t 2, 1845: Endl. Syn. Conf. 176. 18747; Parl. In DC. Prodr. 16,2: 389, 1868; Kurz For Fl. 2: 499. 1877; Hook. FB 15: 632, 1888.

P. merkusii is the most tropical to compare all pines and this common occurring in the southern shan states of Burma. It has been recommended for planting along the eroded hill slopes of the Andaman and Nicobar Islands commonly known as Tnasserin pine, it normally attains a height of c. 20 m when mature. The bark is grey to brocon thick and deeply fissured. The leaves are in pairs, 17-23 cm long. persisting for 1 1/2 -2 years The female cones are cylindrie borne in pairs and at maturity reach length of c 5.7 cm. The umbo is rhomboid and furrowed, the small seeds are winged.

7 ANATOMY OF PINES

The anatomy of plant contains various section of plants like Root, steams leaves Branch etc.

7.1 Root

The plant possesses initially a primary tap-root with a large number of laterals arising in an acropetal succession. In most cases, the growth of the primary laterals, turned long roots, continue to grow. Later, the dwarf roots arise in clusters on the long roots, they branch dichotomously and form coralloid masses. Some of these harbour an ectotrophic mycorrhizal and are turned mycorrhizal roots. There are two types root are found in pines plant

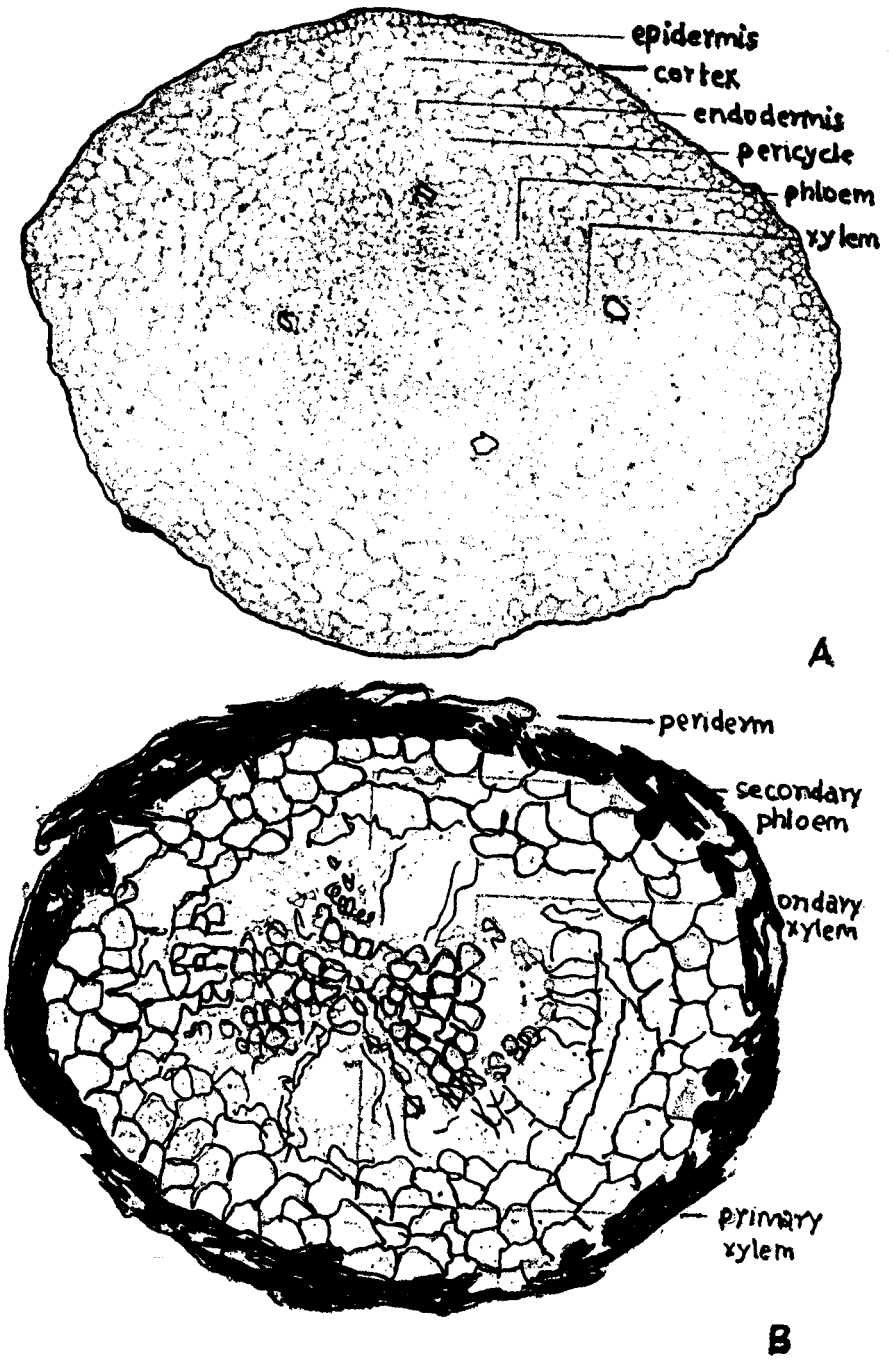


Fig-3. A raxburghii: A T. S
Young Root

(i) Long roots

(iii) Dwars roots.

5.1.1 Difference between long root and Dwarf roots

LONG ROOT	DWARS ROOT
1. Root-cap present	Root-cap absent
2. Ratio of the stele to high	Ratio of the stele to cortex cortex low
3. Fair amount of secondary growth	No secondary growth
4. Starch in cortical cells cells absent	Starch in cortical growth
5. Resin ducts present primary cortex	Resin ducts usually in absent

7.1.2 Root Stem Transition

Konar (1963) studied the root stem transition in *P. roxburghii*. The primary root is diarch near the tip but gradually the number of xylem and phloem bundles increase and at the zone of root stem transition a tetrarch of pentarch condition is observed with the increase in the diameter of the root, the stelar diameter also increase gradually each xylim bundle splits in to two strands which rotate through an angle of 90 and meet an alternating strands of phloem. Finally the phloem also splits. Thus from an originally each condition, the stele becomes endarch and the number of vascular bundle becomes double.

7.1.3 Shoot Apex

Long shoot, the apex of the long shoot undergoes a period of dormancy during October-March. In *P. penderosa* where it has been studied in detail, the apex has a low parabolic dome averaging 72μ in height and 277μ in diameter during the phase of dormancy.

The shoot apex. while active, measures 175-300μ in height and 305-500μ in diameter and is distinguishable into fourzones.

(1) Apical initials

(2) Central zone of Mother cells

(3) Periphenal tissue zone and

(4) Rib meristem

7.1.4 Dwarf Shoot

During the active period of growth the shoot growth the shoot apex is dome shaped but at maturity it appears elongated and cone like. The shooot apex though highly relescoped also shows four zones

(1) Apical initials

(2) Subapical initials

(3) Peripheral tissue zone

(4) Central tissue zone.

8. STEM

The stems of conifers grow from a group of meristematic cells. In some generanotably Araucaria, the apex is organized in to a distinct tunica in which divisions are regularly anticlinal, and a central campus, where divisions are in several planes. The latter gives rise to the pith and primary vascular tissue. The mature stems of conifers consist principally of secondary wood, the pith and primary xylem being relatively inconspicuous. At the out side, the phloem cortex, and periderm also form a comparatively narrow band. In pims it is confined to epithelium of the rusin canals and, it is entirely lacking in taxus. The tracheids are usually differentiated in distinct annual rings. The central part of the pit membrane is thickened and forms the torus thickenings are often present along the margins of the pits, the Rims of Sanio stem of pines bears two types of shoots.

(1) Long shoots or shoots of unlimited growth

(2) Dwarf shoots.

Long shoot. A young stem has ridges and furrows on its surface due to dose a depressing of the surrounding leaves.

The epidermis is followed by a broad cotex. The stele consists of provascular strands arranged in a ring. The cortex

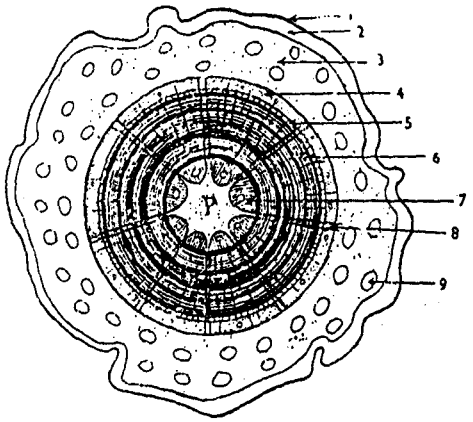


Fig. [illegible]. Diagrammatic T. s. of *Pinus* stem showing prominent annual rings in secondary xylem. 1, epidermis. 2, cork. 3, cortex. 4, secondary phloem. 5, cambium. 6, secondary, xylem. 7, primary xylem. 8, medullary rays. 9, resin-canal. P, pith.

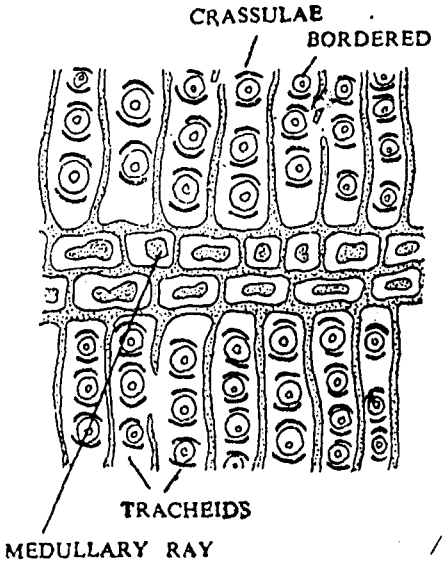


fig- 4 T.L.S of Pinus wood.

as well as the pith are parenchymatous, and many of their cells contain tannin. The vascular tissue in the older stem is better organized and hare the provascular strands mature into vascular bundles. Those towards the pith mature into intrafascicular cambium. The primary collatenal open vascular bundles are separated from one another by broad medullary rays. The resin ducts are arranged in a ring in the cortex . *Srivastava* (1963) has used the term "cambial zone" to designate the entire area of undifferentiated dividing cells.

Various section o Stem

(1) Pith (2) resin duct (3) growth rings (4) secondary phloem (5) secondary cortex. (6) sheath cell (7) epithelial cell (8) cambial zone (9) vascular rays (10) secondary xylem (11) tracheids (12) rings (13) torus (14) Bar of sanio (15) pitapertune (16) others

The structure of the wood has been used as an aid in the identification of not only pines but also of other conifers.

The vascular cambium is being differentiated in the stelar region, a cork cambium arises in the first or second layer of the cortex. This by peridlinal divisions gives rise to the cork or bark at the periphery and the secondary cortex towards the centre. By intermittent articlinal divisions it

increases the number of radial rows and enables the periderm to keep pace with the increase in circumference of the stem. The scaly bark gradually thickness gets cracked externally, and finally wears away.

Dwarf Shoot

The ontogeny of the dwarf shoot has been studied by *Sacher* (1955[a]) in *P. Lambertiania*. Anatomically it resembles the long ducts for its narrow diameter. The cortex is small with few region ducts this vascular bundles are colateral and open but may became siphonostelic. The medutlary rays are broad and parenchymatous. The xylem trachcids are mostly scalariform though occasionally they may be pitted the pith is large and parenchymatons. Many of the cells tannimitenous.

9 LEAF OF PINES

The leaves of the conifers take a variety of forms but they are nearly always small and simple in shape. In Pinus the leafs are various types.

Pines species bears five types of leaves in succession:

(1) *Cotyledon*

(2) *Juvenile*

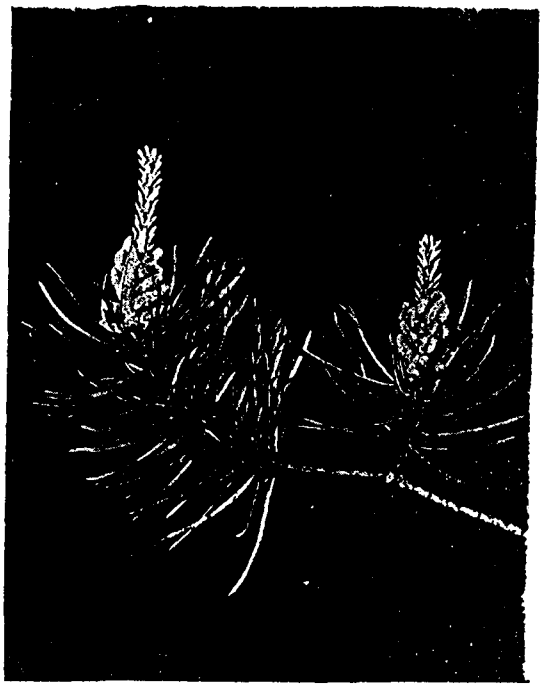


FIG. 6½. Scotch pine (*Pinus sylvestris*). Leaves in clusters of two. Microsporangiate, or "staminate," cones at the base of shoots of the current year. (*Courtesy of Abbott Laboratories.*)

(3) *Prophyll*

(4) *Cataphyll*

(5) *Acicular*

Cotyledon-Leaves

The cotyledonany leaves are the first to arise their number varying from 4 to 15; though three in *P. poxburghii* and eight in *P. sabiniana* have been noted more commonly. In transverse section a leaf is almost triangular with the sides generally longer than the base. The epidermis is made up of single layer of isodiametric cells lined by cuticle. Most of its cells and some of the hypodermal ones contain tannin. The sunken stomata associated with substomaticol cavities one restricted to the lateral sides of the leaf. The undifferentiated green mesophyll consists of isodiametric cells filled with starch grains. Two resin ducts are located below the epidermis of the dorsal surface. The endodermis, made up mostly of barred-shaped, thin walled cells, is followed by the pericycle or T.S, while consists of parenchymatous albuminous and tractriadal cells. A single vascular bundle occupies the centre. Pheloem is composed of parenchyma and sieve cells. The protoxylem has 4-6 Scalari form forma pitted trachirds and the *meta xylem* consists mostly of tracheids with bordered pits.

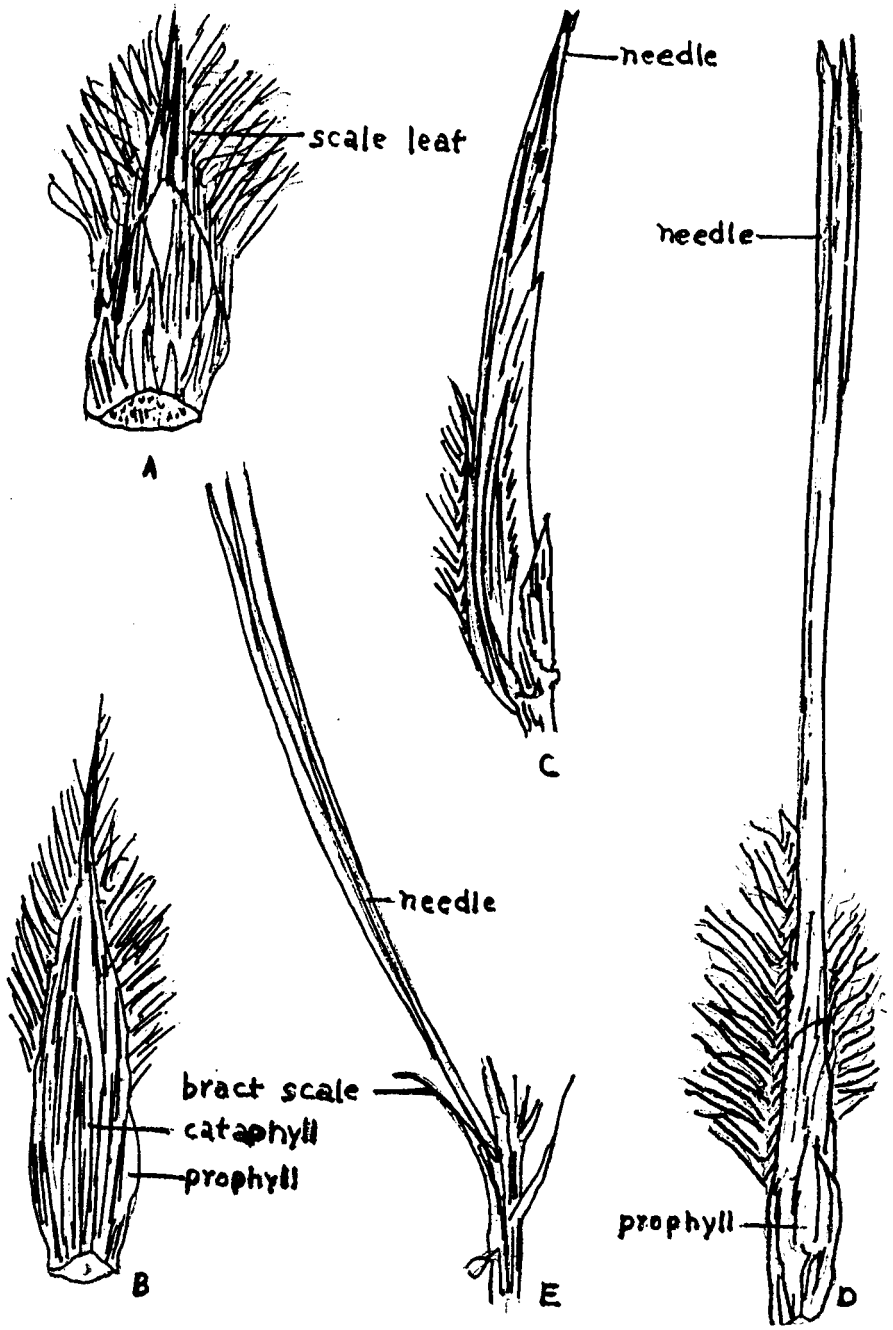


Fig- 7. P roxburghii A-E., Stages in the Unfolding of needle (A, B, X4; C-E X2)

Juvenile leaves

There fellow the cotyle donary leaves and assume the normal function of leaves for 1-3 years. Each leaf has a broad quadrangular outline. The stoma are other substomatal cavity same of the epidermal cells along the margin of the leaf elongate into simple spines. Two resin ducts lie. In the hypodemis along the margin. The mesophyle constitutes closely fitted chlorenchymataus cells with plate like infoldings projecting into cell cavity Ring. lie zones in the wall are found. The mesophyll is followed by a single layered endodermis. The pericycle is 2 to 3 layered with c cells similar to those such in the cotylidonary leaf enclosing a single collateral vascular bundle.

Prophylls and cataphylls

Mostly this types of leaf found in *P. roxburgtic* and others, the prophylls and cataphylls are persistent and in all soft pines except in *P. heiophylla* and *P. lumbioltzii* there are deciduous.

Anatomically both prophylls and cataphylls show the same characters. The epidermis is thinkened more on the adaxial than on the abaxial side. The undifferentiated mesophyll is a characteristic feature of the cataphyles. There is a central, median bundle with collateral

arrangement of phloem and xylem. A lacuna is present two resin ducts normally present. Vascular bundle also available. A weak defined sheath of cells with slightly thickened walls, invests the epithelial cells of the resin canals.

Acicular Leaves

Acicular leaves looks like needle. This type of leaf found in *Pinus spp.* this is borne in spinals on the dwarf shoot or spur after the development of the prophylls and lataphylls. The spur is seldom monophyllous; mostly it bears faceless of two there or five needles.

Lecome (1924) has reported the occurrence of flat leaves on the dwarf shoot. This flat leaf possesses a midrib-like region which is cross section is represented by a single vascular bundle.

Each needle in a cross-section appears triangular with a slightly convex or semicircular base.

Thus the leaf shows prominent xerophytic characters i.g. needle like form thick cuticle, sunken stomata, strong sclenenchymatous hypodermis, simple vascular system and the peculiar transfusion tissue.

10. REPRODUCTION

Reproduction takes place by spores which one

developed in sporangia borne on sporophylls which are aggregated to form compact cones. These structures though primarily asexual (diploid) are very well differentiated as male and female cones because they are monosporangiate in nature. Both cones are borne on the same plant

10.1 Male Cones

Male cones usually appears in May on hills and in January in plains. The male cones are developed in clusters at the base of the youngest shoots in place morphologically equivalent to dwarf-shoots. Each arises in the axil of a scale leaf at the base of the developing rarely more than half an inch in length It consists of a central axis about 5 mm long which bears 60-100 spirally arranged scaly microsporophylls. Each microsporophyll on its underside possesses two avoid microsporangia or pollen-sacs. The microsporangia are eusporangiate in development.

10.2 The Microspore and Development of Male Gametophyte

The microspore has a three layered wall. The exine or the outer layer is heavily cuticularised and is such only on one side of the spore. It does not cover the spore completely. The middle layer or exo- intine covers the spore completely forming two conspicuous balloon-like expansions or wings on either side containing air. This makes the

microspore more buoyant thus justifying its anemophilous nature. The intine or the inner layer is very thin and delicate.

At first, the microspore is a unicellular body. When mature they do not leave the sporangium in this condition but germinate The early development of male gametophyte, therefore, is endospric. The germination is marked by the division of the spore into a very small flattened prothallial cell and a large tubecell.

At this stage, dehiscence of the microsprangium ultimately become empty so that the cone rapidly with off and falls down. This usually happiness in the month of march.

10.3 Female Cones

Female cones laterally in clustered from one to four in the axil of scale leaves in place of branches of unlimited growth. Usually in plains, these developed in winter some times during January, February where as in hills these developed in winter sometimes during January, February whineas in hills these develop in the male cones, ultimately becoming ready for pollen reception in the next spring. When young, each is small, erect and green with soft texture consisting of a central axis bearing spinally arranged scale

like outgrowth. When mature the female cones become brownish red. These are made up of two kinds of structures.

(1) The outer smaller leathery bract scales developed direct on the axis, and

(2) The larger woody ovuliferous scales developed from the former. Each ovuliferous scale bears two ovules on its upper surface.

According to *Konar* (1960), the bract scale, prior to pollination is larger than the ovuliferous scale but the latter soon outgrows the former.

10.4 Morphological Nature of the Ovuliferous

This double structure has long been a morphological puzzle. The following are the various theories which account for the much disputed morphological nature of the ovuliferous-scale.

(1) *Sachs* and *Eicher* regard the ovuliferous as an outgrowth of the bract scale comparable to the ligule of selaginella or flacementa of angiosperms according to them, the female cone may be regarded as a female flower. The cones axis is the elongated thalamus; the bract-scale is the carpillary scale; and the ovulifenous

scale is the placenta bearing ovules. The gynoecium is apocarpous with rudimentary carpels which do not form a closed ovary.

(2) *Kubart* and *Bessey* regard the ovuliferous scale as a combined outgrowth of the ovules and call it an aril.

(3) *Delpino* regards the ovuliferous scale to be formed from two lateral lobes of bract-scale which have been turned inwards and fused together.

(4) *Hirmer* regards the ovuliferous scale and bract-scale as parts of one structure, which has forked vertically as the sporopylls in chinostriobus.

(5) *Braun* regards the ovuligerous scale to represents the first two leaves of an oxilliary shoot, which are fused by their a daxial margins.

(6) *Florin* regards the female cones as morphologically equal to an inflorescence of angiosperms.

10.5 Megasporangia or Ovules

All ovules arise as round-hump of tissue the nucellus formed of a group of cells on the upper surface of the ovuliferous scale. Soon a two lipped covering layer the integument surrounds the nucellus except the inner end when

a wide aperture, the micropyle is left. The micropyles are direct inward toward the axes of the cone. The integlement is fused to the nucellus except for a short distance near the micropyle. It shows three layers, outer and inner fleshy layers and middle being stony. The micropyle is directed obliquely towards the cone axis. At the apex of the nucellus a dupseated cell enlarge to form a large archesporial cell. This divides to form a tapetal cell and a migaspore mother cell. The latter divides to form a linear tetrad of usually four haploid megospores. Ferguson (1506), reported variation in the number of megaspores produced. It is at this stage that the ovules receive the pollengrains. Thus, the pollination takes place when the megaspores have been formed in the ovule. The development of embryo-sac takes places only after pollination

11. POLLINATION

This involves the transfer of anemophollous microspores or pollin-grains to the ovule and is facilitated by the ballon-like expansions. Usually, the pollination occurs some where about the end of May in hills and in plains in the month of February or March at that time yellow clouds of microspores are already in the atmosphere.

Most of the pollen is wasted, but some of the pollen grains are blown by wind in between the ovulifenous scales and finally lodged in the microphyle. The nucellus secretes a mucilaginous fluid which oozes out from the micropyle. This entanagles the pollen-grains and as it dries up, they are finally brought to rest on the apex of the nucellus. The integument scales he micropyle and imprisons the pollen grain permanently. The female cones begin to harder after pollination and become brown.

AFTER POLLINATION MALE GAMETOPHYTE AND FEMALE GAMETOPHYTE DEVELOPED

12. FERTILIZATION

The lapes of time, usually of about 13 months; between pollination and fertilization is one of the features of special interest in Pinus. The pollen tube elongates its neck and bursts often throwing out short branches. The two unequal male nuelis, the tube nucleus and the stalk cell enter the venter but only the larger of the two male nuclei fuse with the egg. institutes fertilization, developing a thick walled diploidoospore. This is completed by the end of June.

12.1 Development of Embryo

Nucleus moves towards the bottom or basal end of the oospore, Here it divide twice to form four nuclei. This is an

extremely short period of free nuclear division in the early embryogeny of Pinus. One more division brings their number to eight. This division is accompanied by wall formations. The first wall formed is transverse to the long axis nuclei into two tiers. This followed by vertical walls which separate the eight nuclei in each tier. At this stage the embryo consists of a lower upper-tier devoid of walls adjacent to the cytoplasm of the egg. Now transverse divisions take place in upper and lower tier respectively. Thus, the oospore consists of sixteen cells arranged in four superposed lier arrangement of the cells of the proenbryo is characteristic of Pinus.

The uppermost tier is called the open tier as it is in open communication with the oospore. This is short lived and soon degenerates. cells but *Buchholz* has reported the development of short lived nosette embryos from the your nosette cells during early embryogeny. The third tier is formed of elongated cells and called the suspensor tier. The lowermost tier is the apical or empryonal tier. A notable future of Pinus is the ultimate separation of the cells of the enbryonal tier into four filamentous embryos. Thus, from a single oospore four potential empryos are formed and this process is called clavage polyembryony. In this long process the embryo fully developed. The four embryos derived from

the cleavage of one proembryo struggle for existence. Out of these only one, usually the lowest and the most aggressive continues to develop and becomes organized in a well difined embryo of the pine seed. Thus it is clear that the embryo is formed only from a part of the oospore. Such a development is called the meroblastic development.

If all the six archegonia of a single female gametophyte are fertilized as a many as 48 embryos are formed. But usually, only one archegonium is fertilized and eight embryo are formed, four form the rosettetier and four from the cleavage process. However, finally only one survive and others degenerate.

Seed

It is the whole structure developed, ultimately from the ovule and its inclusions it consists of

1. Embryo
2. Endosperm
3. Perisperm
4. Seed coat
5. Wing

Thus, the seed consists of structure belonging to two generations, the gametophytic. The endosperm belongs to the former and the embryo, perisperm and seed coat to the latter.

12.2.1 Germination of Seed

The seeds may germinate in the spring or many remain dormat if conditions are not favourable. Under suitable conditions, the seed absorbs moisture which causes the splitting of the seed-coat. The radical grows down towards the soil while the plumule grows upwards towards the light spreading apart the green coat. This is done at the expermse of the endospern, the radicle develops into primary axis of unlimited growth on which are borne acicular, green leaves spirally arranged. The seed shows epigeal germination, in that the cotyledons carry the seed up, along with them. This conditions, better known as '*Juveile condition*' persists until the seeding is 3 to 4 inches in height. The leaves become smaller till they become mere scale-leaves bearing dwarf-shoots in their axisl. This condition is a primitive feature and is characteristic of pines. Ultimately, from this mesophytic juvenile form then develops a xerphytic adult plant.

The Pines takes about three to five years in completing its life-cycle as shown below

13. TIME INVOLVED IN THE LIFE-CYCLE (reproduction) OF PINUS

First Year

Spring 1. Appearance of male and female cones

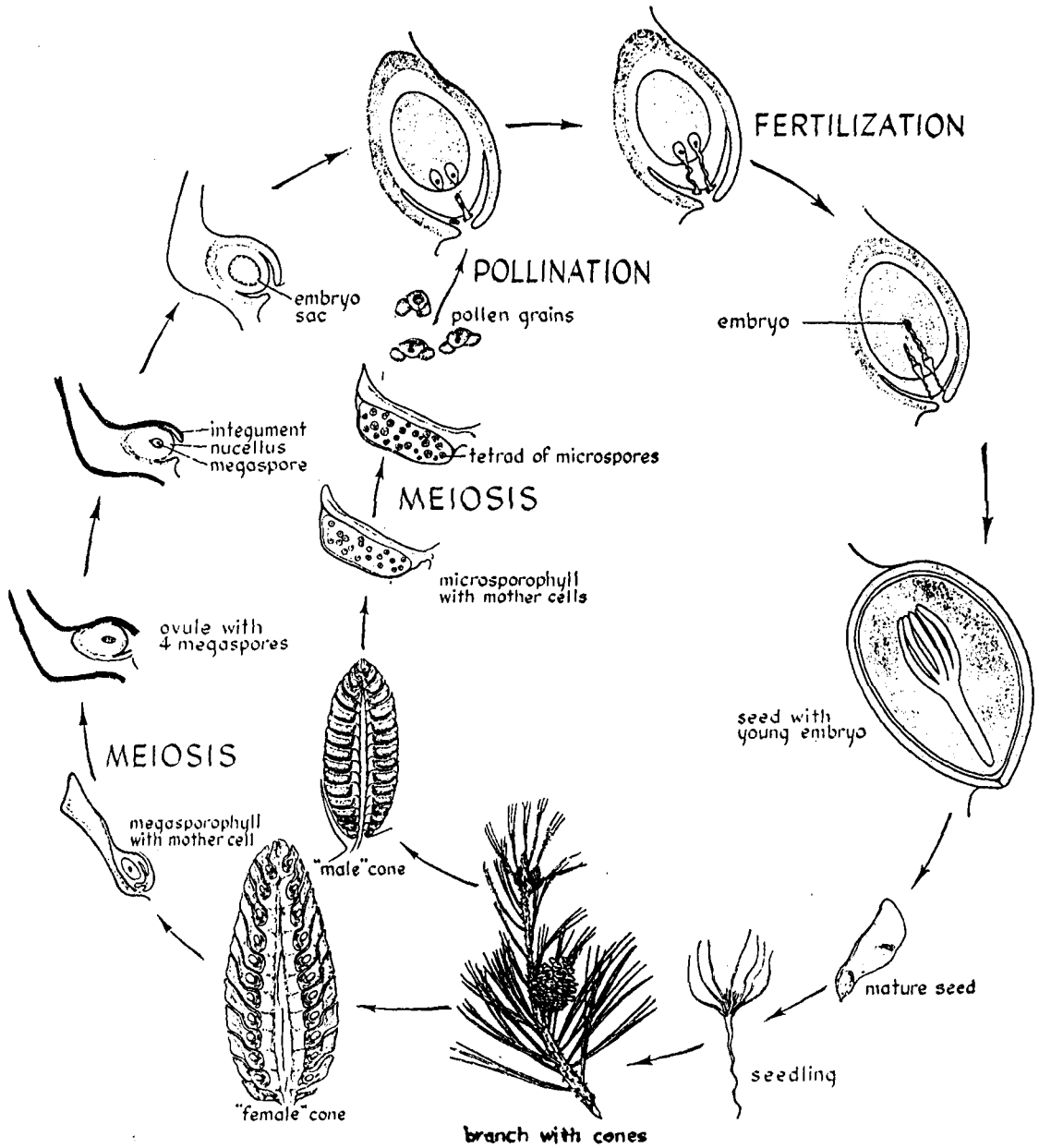


FIG. 8 The life cycle of the pine.

2. Formation of Microsporangia and ovules
3. Opening of scales of the female cone
4. Development of pollen-gnoins.

May or June:- Pollination followed by closure of the scales of the female-cone

Summer:- Development of pollen tube and megaspores

Winter:- Further development of male and female gametophyte.

Second Year

Spring
1. Development of archigenia in the female gametophyte
2. Formation of male-nuclei by the division of body-cell in the pollen tube
3. Formation of eggs.
4. Elongation of pollen-tubes and their archegonia

June:- Fertilization takes place

Summer:- Oospore develops into an embryo and seed is formed.

Third Year

Summer
1. Seed mature
2. Female cones open
3. Dispersal of seeds

Winter No change

Spring:- Seeds germinated and develop a new plant

14. "ECONOMIC USES AND IMPORTANCE"

There are many economic uses or importance have pines in the world of day to day life. These economic use of pines are giving here as follows (1) Pines and timber (2) Kraft paper (3) Resin (4) Medical purpose (5) Food (*P. geradiana*) "the chilgoza pine" (6) To control the climatic conditions (7) Other uses also.

Today every part of the plant is economically exploited so Pinus is an important timber-tree of the world. *Pinus roxburghi* (chir) and *P. walli chiana* (kail) are used in the U.P., Punjab for useful joinery woods. When treated, they make good railways sleepers their wood is also used for shingles, packing cases, constructional work, light furniture, house fitments, street paving, toys, carving, box boards and plane tables. *P. merkusii* provides an useful timber for indoor-work.

In Europe, especially Norway and Sweden, pines form the bulk of the vegetation and the wood is used for making high grade writing and kraft paper, the bark, after treatment has been found useful in making hardboards. The sawdust of *P. monticola*, after further pulrization, is used in linoleum

industry, particularly of the in laid types, plastics, artificial wool, composite flooring and insulation bricks.

Many species of Pinus are tapped for their oleoresin. The living trees, stumps and diod light wood of at least eighteen species montioned in the list are regularly used for this purpose. The derivatives of the oleoresin are called "naval stores" in Europe and the USA. The term is specially applied to the turpentine and rosin obtained by steam distillation of the oleoresin. It also includes pine tar, pine oil and rosin oil.

The development of the resin industry in India was the result of the research work and activities of various forest departments. The first collection of resin was made by the Uttar Pradesh forest department at Chakarata in 1888 and later in 1850 in the Kumaun hills. Soon after wards a small distillation unit was set up at Bhowali near Naini Tal

Method of Tapping the resin

In the earlier days, crude castiron retorts were used for distillation. This resulted in poor quality of the product stills were introduced around 1834. These are partly enclosed in brick work and heated from below. Water is mixed with the oleoresin and distilled. Turpentine distills off leaving the nosing at the bottom of the still. The vapors of turpentine

along with steam pass through a simple dehydrator containing an hydrous sodium chloride. On condensation, turpentine is stored in barrels or tank cars. The molten nosing is drawn off from the base of the still, strained through wire strainers having layers of cotton, and then packed in barrels or drums.

While the pine wood is digested for paper pulp. Turpentine also is recovered by condensing the vapors from the pulping digesters. This by product is contaiminated with various sulphur compounds which are removed by chemical treatment and fractional distillation. The spend cookin liquor obtained from the paper pulp digester, is treated to recover resin acids known as tall oil or liquid rosin.

The USA produces the largest quantities of rosin and turpentine. In the USA dead pinewood contributes C. 2/3 of the total production. The annual world production of lleoresin, excluding the USSR is estimated at (5,00,000 tonnes. two thirds of this is producals by the USA; France occupies the second place, followed by spain and portugat.

India produced about 50,000 tonnes in 1985-90, at present large scale extraction is being carried out in factories at Bareilly Nahan and jammu by steam distillation method; and in a small scale at several location in Hoshiarpur and Rishikesh by direct heating.

Tapping of oleorisin in India is now systematically done in certain areas, and the country is almost self-sufficient in its production.

TURPENTINE is chiefly used as a thinner in paints and Varnishes and as a solvent for rosin and locquer. It is an ingredient of shopolishes, lubricants, scaling waxes and various other substance Rosin, rich in pinene, forms the base materials for the manufacture of synthetic comphor, small quantities are also used in Medicine.

About 80% of the rosin produced in India is being employed by paper and soap in dustines, and the remaining 20% is utilized in the manufacture of paints, varnishes, linolium, phenyl, sealing wax shellac, electrical insulation, gramophone records, oil cloth, heat grease, printing ink, boot polish, etc. However, the use is largely governed by its grade and quality.

The softwood far obtained from pines is used for compounding of rubber and to some extent, in manufacturing aokum for coulking ships, in cordage and in medicine. It also find its use as a floatation oil in the sepenation of minenals and as gasoline gum in hibitor. The heavier fractions are used as preservatives, disinfectants and stains. The pitch is used for sealing cracks, as an insulator, and as a binder for briquettes.

The pine needles on distillation yield an oil which is chiefly used for medicinal purposes. After extraction, the leaves are known as pine wool. There are used for shiffing. Pine needle oil impregnated with Manufacture of coarse matting. Pine needle used as an effective insecticide. The pine tar oil is preferred to refined petroleum oil as a fungicide and on mixing with copper resinate its value exchanged as an in secticide and a fungicide.

The seeds of all pines one rich in fat and proteins, but only in 18 species they are large enough and attractively flavoured to be edible.

The other important edible pine kernel is that of *P.gerardiana*, commonly known as chilgoza or Nioza. It grows mostly in Afganistan and large quantities of seed are imported in India and Pakistan. The tribal people collect the large cones by means of long hooked poles. These are gathered and staked in heaps, while still green and roasted.

The seed of *P.cembra* used also for culinary purpose in switzerland and Rassia.

15. DISEASES OF PINES PLANT & CONTROL

Numerous fungi attack pines, of which some cause local damage and others destroy large scale plantations.

Seedlings of *P. Resinosa* and *P. banksiana* are very susceptible to root injury by off disease caused by Pythium debaryanum Hesse, Fusarium sambucinum Fucked. Pellicularia filamentosa. Rogers and Phomopsis Juniperovora Hahn. The disease results in wilting and finally death of the seedlings. The harvest lost from this disease.

In the nurseries 3. to 5 year old seedlings may be seriously attacked by Diplodiapinea Kickx, causing root-rot, when adult trees are attacked by this fungus, the diseased parts show deepred colour on park and black streaks in attacks the ovuliferous scales of *P. nesinosa*, *P. strobus*, *P. nigra* and *P. virginiana*.

To reduce the infection, pruning and burning of the twigs one recommended. Bordeaux mixture with a stieker may also be applied.

Other fungi that attack pine roots are Botrytis cinerea Pers., Cylindracarpon radicicol Wall. F. culmorum sace *F. orthocinas* Apple and wall etc.

The leave of many pines are also infected by Lophodermium Pinastri chiv. in this effect the pining needles affected by black spots. *P. banksiana* is often severely attacked by Hypodermella ampla (Davis) Dearm by this all needles are drop off. by this many species are effected.

P. nigida is commonly attacked by Hypoderma lethale Dearn. The fruiting bodies are short, narrow and black.

Fruities bodies effected by Maemacy nivcus *P. strobus* is infected by Bifusella linearis by this only needle infected.

Pines are also infected by conker forming fugi by this infection. The branches of various species of pins killed. For controling the diease are DDT, B.H.C. other chemicals solutions and dry matter.

Several species of ceratostomella, an ascomycete, cause blue or grey stain of wood, possibly also trachcomycosis, the most prevalent and wisespread species are: C. ips Rambold, C. bilifera (fr), C. exigna, C. multiannulata, C. pini, C. Plurinulata.

P. virginiona and *occasionally* other species are seriously infectd by an autoecious rust *gallowaya* pinicola Arth. By this the reddish pustules on the needles became prominent in spring and many cause defoliation.

Destruction of the alternate most and spraying or dusting the pines with Sulpher early in the season are some of the methods of control.

The female cones of *P. palustris* are known to be attacked by cronartium strobilium by this the male cone reproductive system effected.

Another important disease known as blister rust of pines is caused by cronartium sp. The pycria and uredia and telia appear on a wide variety of annual and prennials. The rust is known as cronartium ruibicola fisher but the stages on pines are referred to as. *Peridermium* strobi kleb. The pines affected by cronartium quercuum (Berk) Miy. and C. ribicola one widely distributed in North America, Europe, India & other Asian countnies. The seedlings, saplings and young bolis are completely killed. Large trees are affected to such and extent that the timber becomes useless.

A detailed investigation on C. Himalayense Bagehe has been made by Bagehe (1933). It is the most common and destructive of all pine rusts in India. Young sapling and bols are severely attacked and killed out right. In India, this rust affects trees up to 20 years of age, beyond which the appear to be safe from infection. This disease control of the many possible methods like regeneration and eradication of the alternate host. The dissemination of aeciospores has been tentatively fixed at /c 270 m and a strip of this width around the infected pine strands is recommended to be kept free of swertia spp. The best time for eradication is soon after the rain and this control by climatic conditions or chemicals.

Young seedlings and small sapling of *P. wallicmiana* are infected by *C. ribic ola* Fischer. control this diesel oil a mixture of sodium chlorate and borax (1:5) and common salt and borax or with saturated aqueous ammonium thiocyanate or ammonium sulphamatic.

The comandra blister rust caused by cronartium comardnae Peck is a widespread disease and is known to attack atleast 12 species of diploxylon pines. Spindle shaped swellings are formed on branches and trunks of trees. Many species of hard pines are infected by *C. cerebrum* Hodge & long in the USA and Canada

Armillaria mellea (Fr.) Quel, commonly known as "shoe-string fungus" or "roney-Mushroom" infects many species of pine. When the fungi attack, the large quantities of resin flow the bark and the wood, fans of radiating flat, white mycelial mats and black rhizomorphs or flat shoe-strings appear Most of the foliage turns brown.

Fomes Pini karst is the chief cause of rot on standing pine timber. It develops white pockets in the wood. The sporophors are irregular with light bron pore surface.

The pitch-canker of pines is potentially an important disease caused by Fusarium spp. the branches of the trees are rapidly killed by girdlings. pasysypha fuscosanguine

rehm causes canker of pines in North America and scandinavia. This causes heavy rusin flow.

Septobasidium pinicola Snell is another important rust which attacks branches of *P. strabus*, *P. albieaulis P. aristata*, *P. halfourina* and *P. torreyana.* This rust is always associated with sclae insects.

16. MYCORRHIZA

There is a widespread occurrence of ectotrophic mycorrhizae in Pinaceae. Ectendotniphi mycorhizae occur in *P. Ponderosa* and *P. controta*, *P. strobus* and other species. Also. It if another disease of pines. This mostly found in root of pines. This disease is mostly attacked by mycorrhizal fungi like bletus variegalus, *P. granulahis L.*, *P. Luteus L.* and others.

17. ANGIOSPERMIC PARASITES IN INDIA-OF PINES

A minutissimum Hook.f. is the only species occuring in India and parasitizes *P. wallichiana.* The other important species known to infected pines one A. oxycedri (DC) M. Bieb, A. americanum Nutt, ex A. Gray, A. vaginatim and A compylopodum A. gray.

The parasite has a part of the plant growing within the host tissue and the rest contitutes the aerial part. The

portion growing within the host tissue has been interpreted in varios ways. Schrenk (Kuijt, 1960) calls it a rhizome; Heil (1923) and Peirce (1905) called thallus and Thoday and Johnson (1930) treated it as an endophytic system

The development of the endophytic system of India species has been worked out by Bhandari and Nada (1970). This parasites fully effected the pines by tis the anatomy of pine or embryology of pine effected.

18. PESTS OF PINES

There are many pests which are attacked on the pines various species of insects cause considerable damage to the pine trees.

A1

Name of insects/ Pests	Name of Pines species	Effects.
1. Hvlobius abietisL H. angustus (India)	*P. wallichiana*	roots and young trees Branches
2. Larva of Diprion Pini L	*P. wallichiana* others	Young & old trees caused living shoots of trunks & branches
3. Pine-aphids (Adelgis spp.)	various species of Pines	whole plant effected
4. D. forntalis (hard-skilled insects)	*P. strobus&P. Ponderosa,* & all species of Pinus	injury to the cambium
5. D. Jeffreyi	all species of Pinus	infected outer cavity membrane surface
6. Moth- it is serious pest of Eurpian pine	*P. sylvestris & P. risinosa* in particular	The damage is most obvious in tree 1.2 m in height
7. (Woo-boring beetles) Monochamus notatus M. scutellalus	all species	Woody portion of pines
8. Phenaspis pinifoliae	Leaf of all pines	Leaf are logitudinally scattered or infected.
9. Pissodes strobi white(Pine-Weevil)	some species	Larva feed on the inner bark& sapwood of the beeding branches & terminal sources of the main trunks
10.Carphoborus-zhobi, Pityogenes scitus	*P. gerardiana &* *P. rox burghii*	Branches and filled sturnps are attacked
11.Carphobonus costalus orthers	Blue pine(*P. wallichinana*)	The safe wood of felled Timber is destroyed

19. CONTROL OF PESTS

Pests control has been effected by spraying DDT, fuel-oil solution of napthalene, o-dichlorobenzene, and p-dichlorobenzene. Imprevement of sanitation also prevents the spread of insects and other chemicals also use for conrol the insects and other diseases.

20. VARIOUS SPECIES OF PINUS IN THE WORLD AND COMMON NAME OF SPECIES

B2

SPECIES	COUNTRIES	COMMON NAME
Pinus albicaulis Engelem	USA	Whitebark pine
P. aristata Engelm.	USA	Bristlecone pine
P. arizonica engelm.	USA	Arizona pine
P. armandii Franch	Western China, Formosa, Eastern India, Japan	Armand pine
P. attenuata Lemm.	USA	Knobcone pine
P. ayacahite Ehren.	Central America *(Guatemala)*	Mexican white pine
P. balfouriana Grev. & Balf	USA	Foxtail pine
P. banksiana Lamb.	USA	Jack pine
P. brutia Ten.	Eastern Mditerranean Region, Iraq, Syria, Turkey, Greece, Lebanon. Islands of Chios, Samos, Rhodes, Crete, Cyprus	Calabrian pine
P. bungeana Zucc.	China	Lace-bark pine
P. cararíensis C. Smith	Canary Islands	Canary pine
P. caribaea Morelet	USA	Caribbean pine
P. cembra L.	Alps of central Europe, USSR, Switzerland, Italy	Swiss stone pine
P. cembroides Zucc.	USA	Mexican pinon
P. chihuahuana Engelm	USA	Chihuahua pine
P. clausa Vasey	USA	Sand pine
P. contorta Dougl.	USA	Lodgepole pine

P. cooperi blanco	Mexico	Cooper pine
P. coulteri D. Don	USA	Coulter pine
P. cubensis Griseb	Cuba	Cuba pine
P. culminicola Andresen & Beam.	USA	
P. dalatensis de Ferre	South Viet Nam	
P. densiflora Sieb. & Zucc.	Japan	Japanese red pine
P. douglasiana Martinez	Mexico	
P. durangensis Martinez	Mexico	Durango pine
P. echinata Mill	USA	Shortleaf pine
P. edulis Engelm	USA	Colorado pinon
P. eldarica Medw	USA	
P. elliottii Engelm. va. elliotti va. densa Little & dor	USA	slash pine of South florida
P. engelmannii Carr.	Mexico, USA	Apache pine
P. fenzeliana Hand, Mazz	Hainan Islands	
P. flexilis James	USA	Limber pine
P. funebris Komarov	North Korea, adjacent part of Russian Maritime Province	
P. gerardiana Wall. ex Lamb.	Afghanistan, Pakistan, India	Chilghoza pine
P. glabra Walt	USA	Spruce pine
P. greggii Engelm	Mexico	Gregg pine
P. halepensis Mill	Spain Portugal, Southeast France, Italy, Greece, Asia Minor, Cyprus, Algeria	Aleppo pine
P. harkvegii Lindl	Mexico	Hartweg pine
P. heldreichii Chr.	Northeastern Greece, Albania, Yugoslavia, Italy	Heldreich pine
P. herrerai Martinez	Mexico	
P. himekomatsu Miyabe & Kudo	Japan	Japanese white pine (Himekomatsu)
P. hwangshanensis Hsia	China	
P. insularis Endl.	India, Burma, Philoppines	Luzon pine
P. jeffreyi Grev. & Balf.	USA	Jeffrey pineP.
koraiensis Sieb. & zucc.	Eastern Russia, Manchuria, Korea, Japan	
P. krempfii Lecomtre va. poilanci	Viet Nam	
	Viet Nam	
P. kwangtungensis Chun	Southern China	
P. Lamberliana Dougl.	USA	Sugar pine
P. lawsonii Roezl	Mexico	Lawson pine
P.leiophylla Shiede & Deppe	Mexico	Smooth-leaved pine

P. luchuensis Mayr	Tyukyu Islands	Luchu pine
P. lumholtzii Rob. & Fern.	Mexico	Lumholtz pine
P. massoniana Lamb.	China	Masson pine
P. merkusii Jungh & de Vriese	Burma to Philippines	Tenasserim pine
P. michoacana Martinez	Mexico	
P. monophylla torrey	& de Vriese	Singleleaf pinon
P. montana Mill	& de Vriese, Pyreneese to Carpathians	Montezuma pine
P. montezumae Lamb.	Mexico	Montezuma pine
P. monticola Dougl. ex D.Don	& de Vriese	Western white pine
P. morrisonicola Hayata	Formosa (Taiwan)	
P. muricata D. Don	& de Vriese	Bishop pine
P. nelsonii shaw	Mexico	Nelson Pinon pine
P. nigra Arn.	mediterranean region	Austrian pine
P. oaxacana Mirov	Mexico	
P. occidentalis Swartz	Caribbean area (Hispaniola, Western Cuba)	Cuban pine
P. oocarpa Schiede	Mexico	
P. palustris Mill.	& de Vriese	Longleaf pine
P.patula Schl. & cham.	Mexico	Jelecote pine
P. pentaphylla Mayr	Japan	Japanese white pine
P. peuce Griseb.	Balkans	Balkan pine
P. pinaster Ait.	USA	Cluster pine
P. pinccana Gord.	Mexico	Pince's pine
P. pinea L.	Portugal to Turkey	Italian stone pine
P. pityusa Steven	Eastern Coast of Black Sea	Pitzunda pine
P. ponderosa Laws.	USA Ponderosa pine	
P. pringlei Shaw	Mexico	Pringle pine
P. pseudostrobus Lindl	Mexico	False Weimouth pine
P. pumila Regel	Northeastern Siberia, Eastern Asia, Central Japan, Anatolia, Syria	
P. pungens Lamb.	USA	Table mountain pine
P. quadrifolia Parl.	USA	Parry pinon
P. quadrifolia parl.	USA	parry pinon
P. radiata d. Don	USA	Monterey pine
P. resinosa Ait.	USA	Norway pine, Red pine
P. regida Mill.	USA	Pitch pine
P. roxburghii Sarg.	Pakistan, India	Chir pine
P. rudis Endl.	Mexico	
P. sabiniana Dougl.	USA	Digger pine

P. seotina Michx.	USA	Pond pine
P. sibirica Mayer	Siberia, Northern Mongolia, Eastern Europe	Siberian pine
P. strobiforms Engelm.	Mexico	
P. strobus L. var. chiapensis Martinez	Mexico	Chiapas pine
P. sylvestris L.	Scotland to the Okhotsk Sea, Coast of Siberia, Norway to Northern Mongolia	Chiapas pine
P. tabulaeformis Carr.	Northern China	Chinese pine
P. taeda L.	USA	Loblolly pine
P. taineanensis Hayata	Formosa (Taiwan)	Formosa pine
P. tennifolia Benth.	Mexico	
P. teocote Schl. & Cham.	Mexico	Aztec pine
P. thumbergii Parl.	Japan	Japanese black pine
P. torreyana parry ex Carr.	USA	Torrey pine
P. tropicalis Moreler	Cuba	
P. virginiana Mill.	USA	Virginia pine
p. wallichiana A. B. Jacks	India	Blue pine
P. washoensis Mason & Stocwell	USA	Washoe pine
P. yunnanensis Franch.	China	Yunnan pine

CHAPTER-III

MATERIALS AND METHODS

MATERIALS & METHODS

1) INTRODUCTION:

The dynamic growth of literature and rapid development of information centres generated several evaluationary studies about the effectiveness and efficiency of information services. These studies led to the identification & application of appropriate quantitative measuring techniques known as bibliometrics. In the information centres of the world the library and information managers began to use bibliometrics techniques in their day to day administration. These bibliometric studies throw light on the pattern of growth of literature, inter-relationship among different branches of knowledge, productivity and influence of authors, pattern of collection build up, their use etc. For this purpose many information scientists have given some laws and these law follow the results of studies, so day to day bibliomatrics is attaining inter disciplinary character and sophistication.

Reference materials are required for up-to-date information in various fields due to the explosion of knowledge and with the rapid changes noticed in all domains of human activity. But efficiency cannot be ensured unless

this service is planned and executed in accordance with various factors of information science. So it is the major development in the field of information science. By its the help we can give many systematic Laws about literature.

2. RELEVANCE OF STUDY:

This bibliometrics studies use various techniques or various searching process like - language distribution, ranking of authors study of core journals, use of key word inter-disciplinary nature of subject, value of literature, Bibliographic control, and geographical distribution, research development and growth of literature etc. This study is most effective for time saving, and by this study systematic picture of literature is developed.

3. OBJECTIVES OF THIS STUDY:

The specific objectives of this study are the following:

1. To identify the core journal of literature on Pines.
2. The determine the ranking of authors.
3. To determine the authorship patterns in the literature of pines.
4. To identify the language of literature.
5. To determine the ranking of institution.

6. To identify the publication of literature countrywise.

7. To determine the year wise productivity of literature on pines.

4. METHODOLOGY OF TOPIC SELECTION:

The methodology of topic selection was a long process. In this process the first step was search for reliable topic. For this purpose I consulted various Department of A.M.U. and identified and various secondary sources for selection of topic, these are Chemical Abstract, Physics Abstract, Biological Abstracts). There sources contain various subjects or areas of studies.

After long process I found a more specific topic in biological abstract. The topic is Pines tree which is a small area of Forestry and Forest Product but this small area has a great value in this field. It has a very useful economic importance in the day to day life so it is more useful for bibliographic analysis.

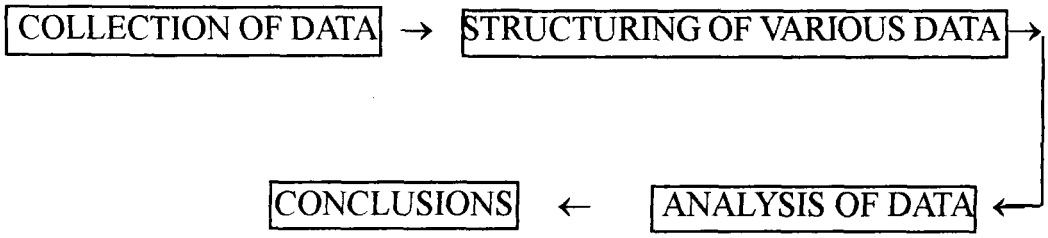
After making reference card, analysis the work with a technique, the different data are collected and give some specific tables. In addition to this document analysis , preparation of frequency distributions, calculations of

percentage, graphical representations and statistical analysis are also used.

5. METHODOLOGY OF BIBLIOGRAPHIC ANALYSIS

Egghe has proposed the following methodology of bibliomatrics analysis.

The present study have gone through the following, which is some how similar with Eggle methodology.



5.1 DATA AND SELECTION OF SOURCE DOCUMENTS:

It is clear from the selection of topic that Biological Abstracts is the basic source document of our data. This is the most useful secondary source of our bibliographic analysis. It is the most authentic, authoritative and comprehensive source for bibliographic analysis. Biological abstract is a bimonthly publication issued by BIOSIS (Biological Information Service) from Philadelpia USA, since 1927.

5.2 REFERENCE CARD:

Reference card were prepared according to bibliographical rules. In the card first write the surname of authors in capital words, forename in (bracket) with small letters. Then fullstop (.) Title of the articles then fulstop (.) name of the journal with vol. no and page then full-stop (.) year of publication after that add of the institution in bracket, and next line write the language of the document.

5.3 ANALYSIS: THE VARIABLES ANALYSED ARE:

1. Ranking of authors are analysed
2. Study of core journals
3. Year wise productivity of Papers
4. Nature of Authorship
5. Distribution of language
6. Analysis of literature country wise.
7. Analysis the ranking of institution.

5.4 METHODOLOGY OF VARIOUS BIBLIOGRAPHIC ANALYSIS

i) **Ranking of Authors:** It is essential prepare a ranking list of author, for this we first take the author data from reference card and prepare a list. In this study of I prepared

a different table for every year (1994 to 1998) and one table for five years ranking of author by the help of Lotka's law of scientific productivity.

According to this law. It is clearly comes the frequency of person and contribution of papers. I carefully prepare the table for ranking for author.

ii) Ranking of Journal : To know about core journals I prepared ranking list of authors. This data was taken out from 1033 reference cards of five year study. After taking the data, I prepared a rank list of journals the journal which contained most numbers of papers about pines had first rank for that and that which had minimum papers the last rank. By this table we can find core journal by the help of Bradford's law. In this study of 132 Journals are contain pines literature.

According to Bradford law core journals are

$1:n:n^2$

$6/1: 6x4/n: 6x4x4/n^2$

Here $25 = 6x4$

And $101 = 6x16 = 6x4x4$

Or $6: 6x14 : 6x4^2$

Substituting n = 4

i.e. 6:6n: $6n^2$

i.e. 1:n:n^2

where, 6 represents the core journals or represents the number of journal in the nucleus n=4 is a multiplier.

Thus, Bradford law of scattering testing.

"In this process the core journals represent but the no of articles are not constant in last zone P3".

iii Yearwise Productivity of Papers

Yearswise productivity of papers consisted of 1033 references, during the period of study 1994 to 1998. From this period I carefully consulted the data of five year period and give the yearwise break-up. This yearwise productivity of papers is given in table and diagram in the next chapter.

iv Nature of Authorhip

First collected the data (1033) and found the type of authorship. It was found that many authors write papers in joint authorship. After this process a table for single or joint authorship year wise was produced, in the next chap. It contains five year authorship.

v Language Distribution:

One of the main characteristics of literature on international level that it have many different language so to know about the various language first arrange the data according to various language and after this arranging of data, provided a rank as well as % value table in next chapter.

vi Analysis of Literature Countrywise:

County wise distribution of literature was easily done for this process first distributed the data from 1033 reference according to addresses when our data was arranged, me provided a systematic rank according to percentage value in one table in next chapter.

VII Ranking of Institutions

For the ranking of institution, first we wrote the address in the reference card, so for ranking of instituions that is which institution produced more research or more literature we collect the various addresses from the refernce cards and prepared list year wise. The institution having more productivity was provided first rank and which have minimum productivity provided lst rank.

6. ANALYSIS OF CITATIONS

Citation analysis is used in the present bibliographic analysis of pines to understand the nature and characteristics of pines plants reserch. Citation refernces are appended to scientific papers, notes, review, coorespondence etc. Published in scientific journals. The analysis of ther citation have been established as a mehtod of studying the journals as well as the people and the work of science. The citation links provide quantitave picture of the journal utility and relationships that are useful in many ways. Here, the conclusions mainly based on what scientists say about the utility and relationship in thie rchoice of refernces. These varies according to function of the journal:

The primary purpose of citation is to enable a reader to go to the referred to document for information on a point or check the authenticity of a particular point of view, findings or method. Each citation is a message from the author of a document to his readers.

7. SELECTION OF PAPERS FOR ANALYSIS OF CITATIONS:

Reference are 1033, from all references, I selected some limited papers which are found in our A.M.U., Department

of Botany in more than one journals. When I consulted the various papers in the various journals, then journal that only 18 papers are found of five years study. So after this have done analysis of citation, where 174 citations or references were found. Although this is a very limited study, but I analysed it to get some idea of citation analysis.

7.1 - Citation & Other Purpose:

* as a bibliography tool
* for preparing a ranked list of peaiodicals
* for understanding the relative use of different types of documents.
* For calculating the useful life of documents
* To calculate the citation-rate of journals.
* To find out the relatedness and dependence of subjects.
* To find the impact factor for a concerned journal.
* To calculate the immediacy index.

8. METHODOLOGY OF CITATION ANALYSIS

Entries were made for she citations on 5"x3" card, indicating the relation between the cited and the citing document. It contains details of the cited authors (Single, Joint), cited paper, source of cited paper, year of source, and

title of cited paper, source of citing paper etc. and 174 cards prepared because all the papers (1033) could not be subjected to analysis mainly due to shortage of time.

8.1 Analysis:

1. Distribution of papers and citation 1994 to 1998.
2. Type of documents cited.
3. Ranked list of journals cited.
4. Identification of joint & single authorship.
5. Identification of co-citations. (most - productive document).
6. Half life period study.
7. Study of cited years

CHAPTER-IV

TABLES AND ANALYSIS

TABLES AND ANALYSIS

1. YEAR WISE DISTRIBUTION OF PAPERS

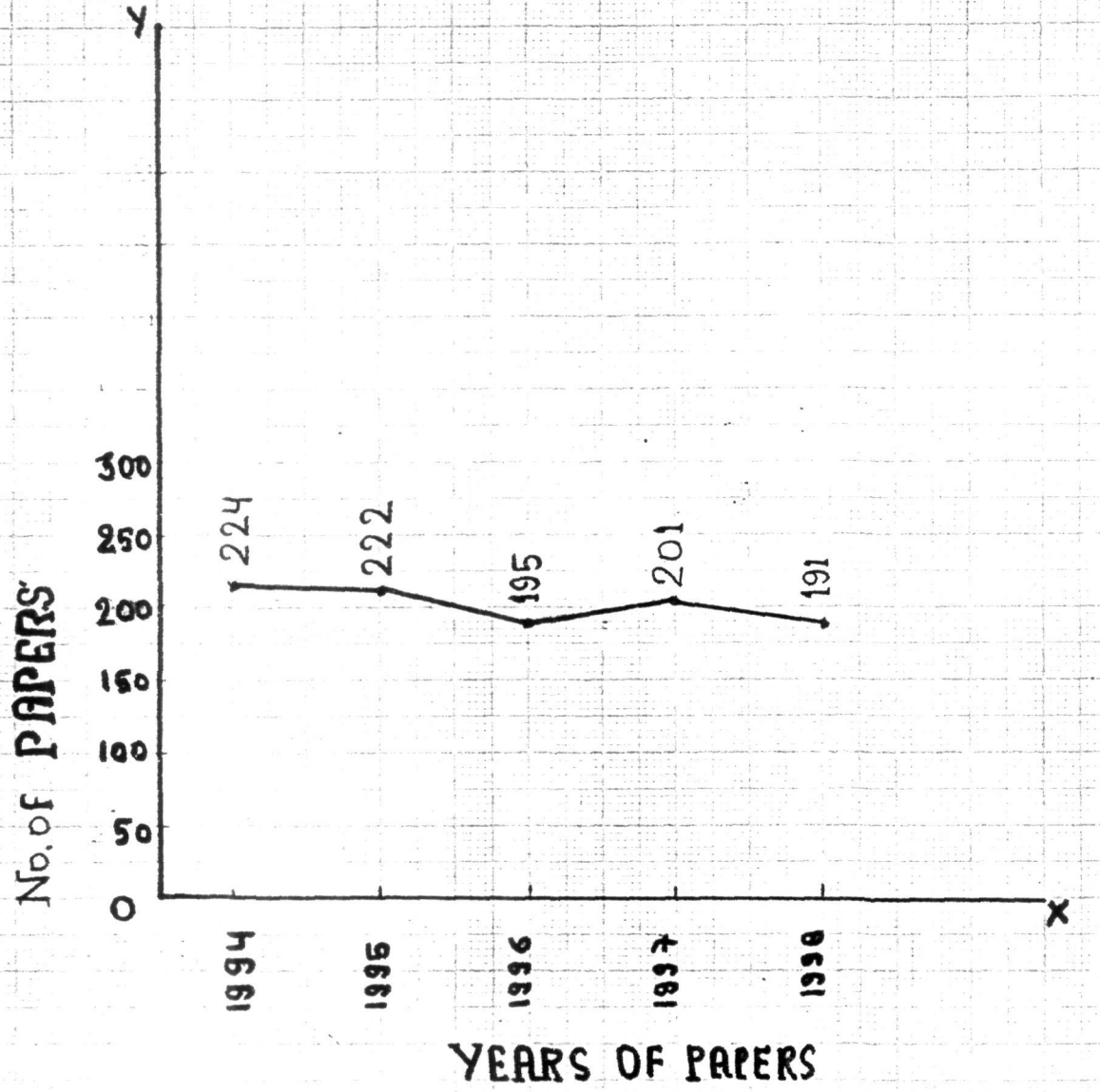
Table 1 gives the distribution of papers published on the pines literature, year wise from 1994 to 1998. During the last 5 years, from 1994 to 1998, the total number of papers published are 1033. The average annual output is thus a little over 206 papers. The maximum number of paper 224 were published in 1994 and minimum number of papers in 1998 i.e. 191. In 1995 the number of papers was 222 in 1996, 195, in 1997. They were 201, and in 1998,191 paper are published. So here total 1033 papers have been published in 5 years.

The year-wise distribution of papers is shown in graph 1

TABLE 1

YEAR-WISE DISTRIBUTION OF PAPERS (1994-98)

S/NO.	Year of Pub.	No. of Papers	Percentage%
1	1994	224	21.68
2	1995	222	21.49
3	1996	195	18.87
4	1997	201	19.45
5	1998	191	18.48
		1033	100%



Grafic representation of Papers (1994-98)

GRAPH - 1

2. AUTHORSHIP PATTERN

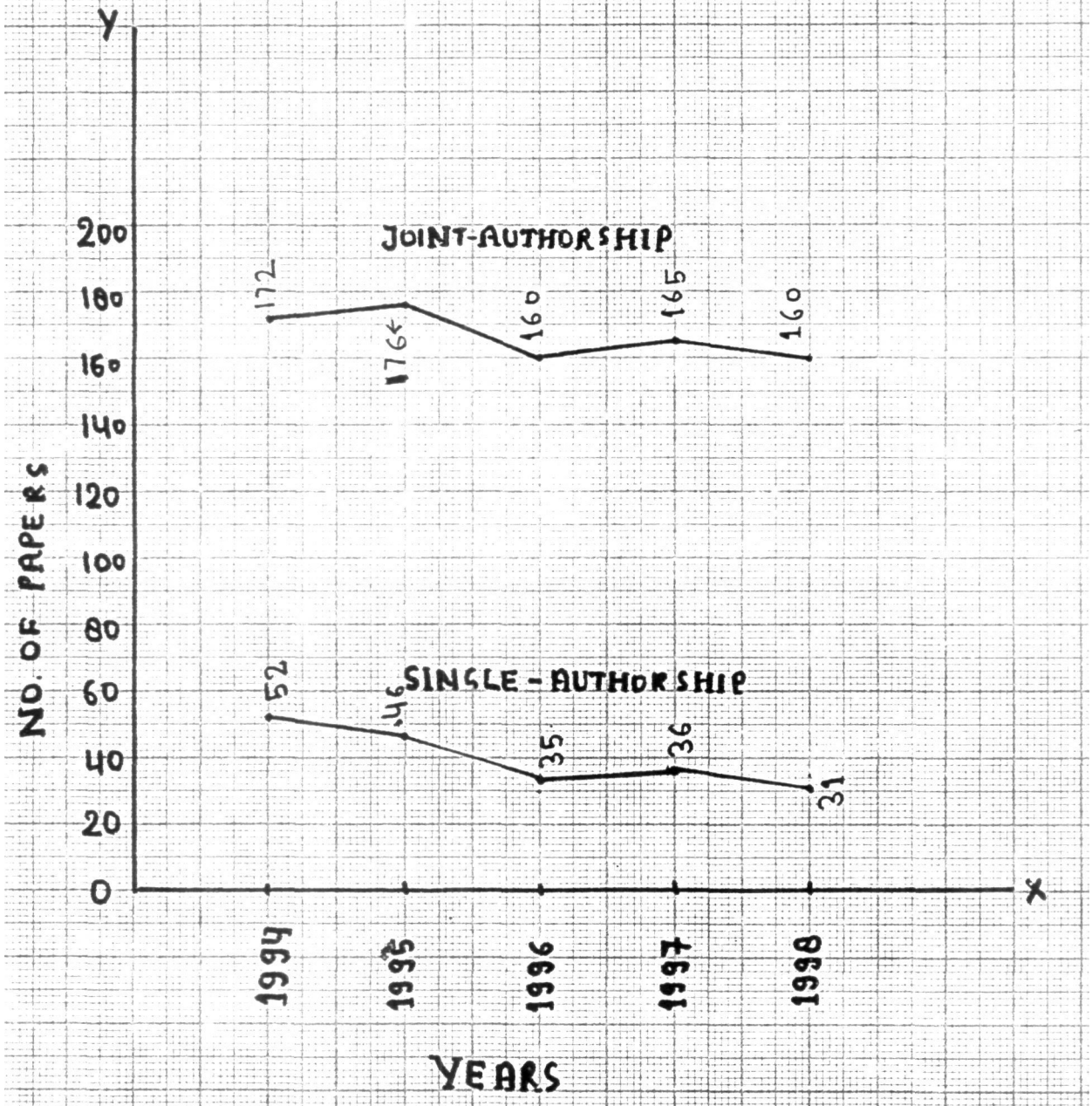
The table 2 represent the data of authorship in five years (1994 to 1998). From the following table it is clear that joint authorship is many times the single authorship every time, highest single authorship is in 1994 and lowest in 1998. But in joint authorship I found that High productive rank of joint authorship in 1995 (176) and lowest rank productivity in two year 1996 (160), 1998 (160).

Following table 2 the Diagrammatic representation and graphic representation is also given. This also indicates data of authorship. The graphic representation of joint and single authorship are similar in nature.

Table 2

TABLE FOR AUTHORSHIP (1994 TO 1998).

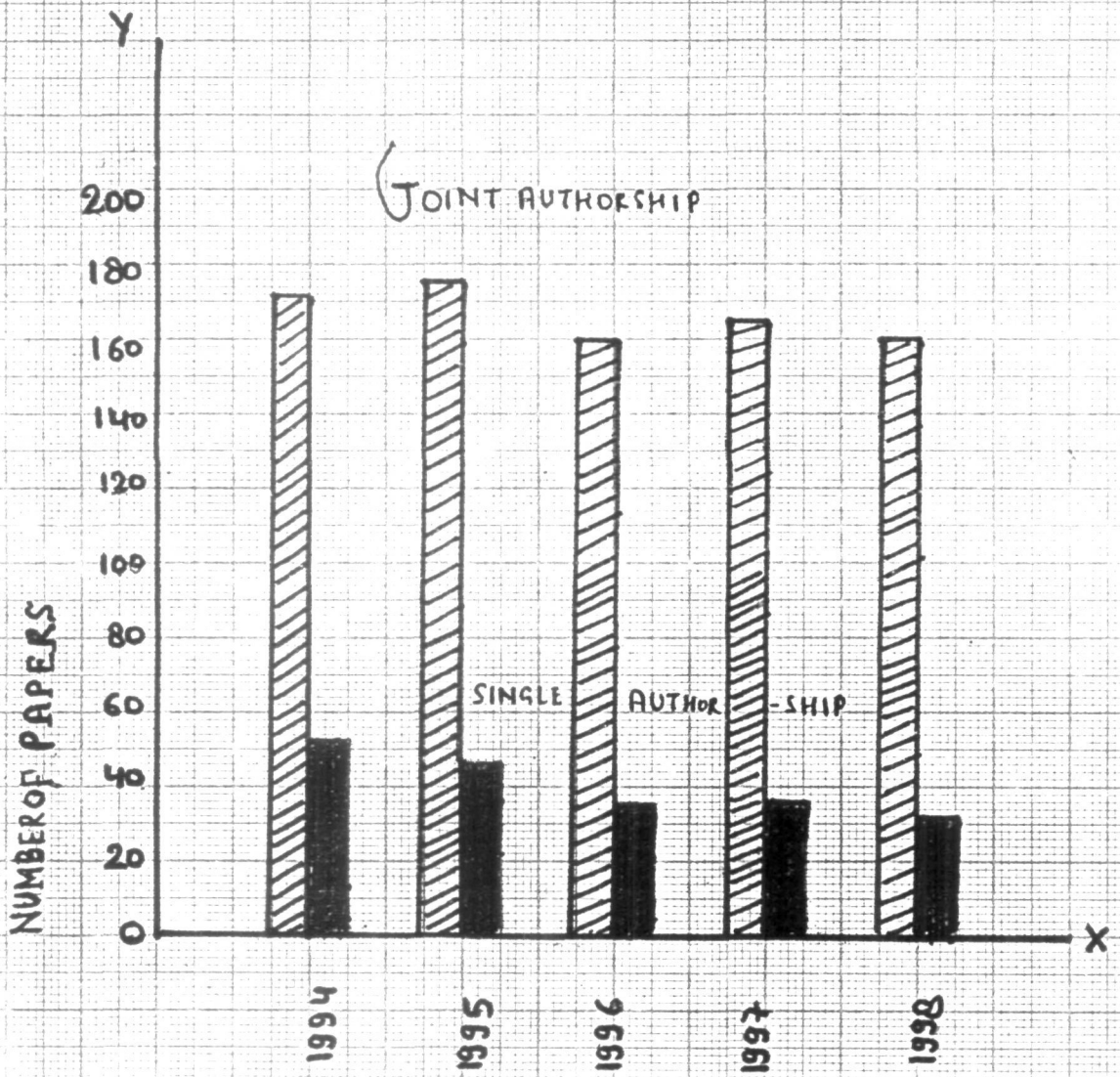
Year of Papers	Joint Auth.	%	Single Auth.	%	Total Paper	%
1994	172	20.6	52	26	224	21.68
1995	176	21.12	46	23	222	21.49
1996	160	19.20	35	17.5	195	18.87
1997	165	19.80	36	18	201	19.45
1998	160	19.20	31	15.5	191	18.48
	833	100	200	100	1033	100



Graphic Representation of ~~Authership~~ Patterns

Graph – 2

DIAGRAM – 9



YEARS-WISE JOINT & SINGLE-AUTHORSHIP

Digrametic Representation of Authorship.

3. LANGUAGE DISTRIBUTION

It is one of the most important character for research work at international level because, various language are popular in the world so here it is essential that to know about more productive language. The Following table 3 shows the productivity of various language, From the present data of five year it is clear that in Pines literature, English has got first rank in all 14-15 language of the world and the second rank gots to chinese in all five year comparative study. German, Korean, Russian, French are the most important language of pines literature. From the comparative study of these four language German, Russian, Korean have got alternative third place in various table in five Year 1994 to 1998.

When we compare English to all the various language then we found that English is a more productive language to others.

English = 80%

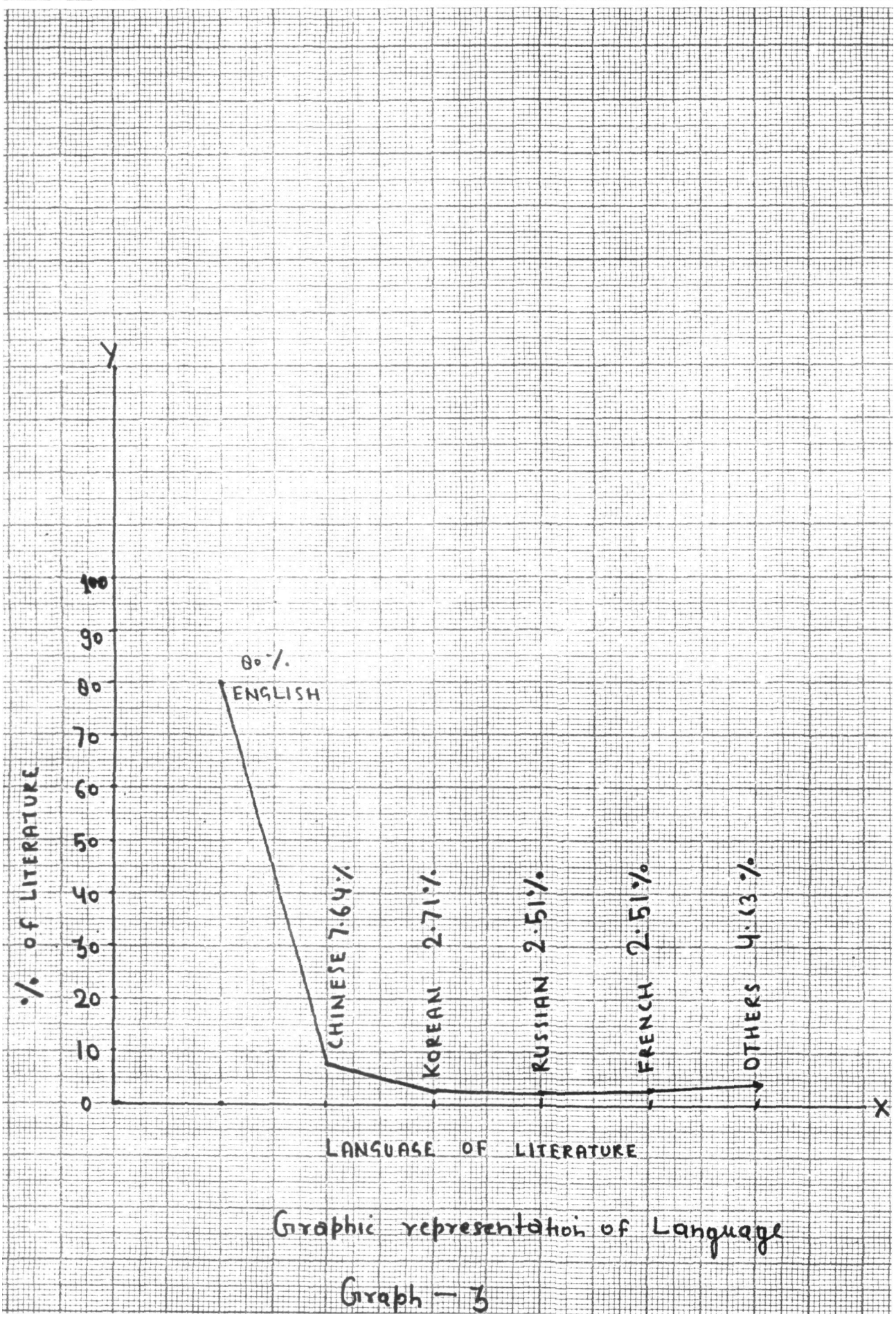
Others = 20%

So here in the pines literature almost 80% papers are coming in English and 20% papers are coming in other 13-14 language. These various languages are represented in graph number-3.

Table 3

TABLE FOR LANGUAGE DISTRIBUTION OF LITERATURE IN FIVE YEARS (1994-98)

S.No.	Languages	Rank	1994	1995	1996	1997	1998	Total	%
1.	English	I	175	173	165	163	157	833	80
2.	Chinese	II	14	20	12	21	12	79	7.64
3.	Korean	III	5	9	4	6	4	28	2.71
4.	Russian	IV	11	6	4	--	5	26	2.51
5.	French	IV	3	3	5	8	7	26	2.51
6.	German	V	4	2	3	--	2	11	1.06
7.	Bulgarian	VI	3	3	2	--	2	10	0.96
8.	Spainese	VII	4	--	--	1	1	6	0.58
9.	Italian	VIII	--	5	--	--	--	5	0.48
10.	Portugal	IX	3	--	--	--	--	3	0.29
11.	Norwegian	X	--	--	--	1	1	2	0.19
12.	Swedish	XI	--	1	--	--	--	1	0.09
13.	Japanese	XI	--	--	--	1	--	1	0.09
14.	Finnish	XI	1	--	--	--	--	1	0.09
15.	Czech.	XI	1	--	--	--	--	1	0.09
			224	222	195	2011	91	1033	100%



Graphic representation of Language

Graph – 3

YEAR WISE LANGUAGES OF 1994 TO 1998 LITERATURE

TABLE 3.1:- LANGUAGE DISTRIBUTION OF 1994

S.NO.	RANK	Language	Frequency	Percentage
1.	I	ENGLISH	175	78.12
2.	II	CHINESE	14	6.25
3.	III	RUSSIAN	11	4.91
4.	IV	KOREAN	5	2.23
5.	V	GERMAN	4	1.78
6.	VI	FRENCH	3	1.33
7.		OTHERS	12	5.35
			224	100%

TABLE 3.2 LANGUAGE DISTRIBUTION OF YEAR 1995

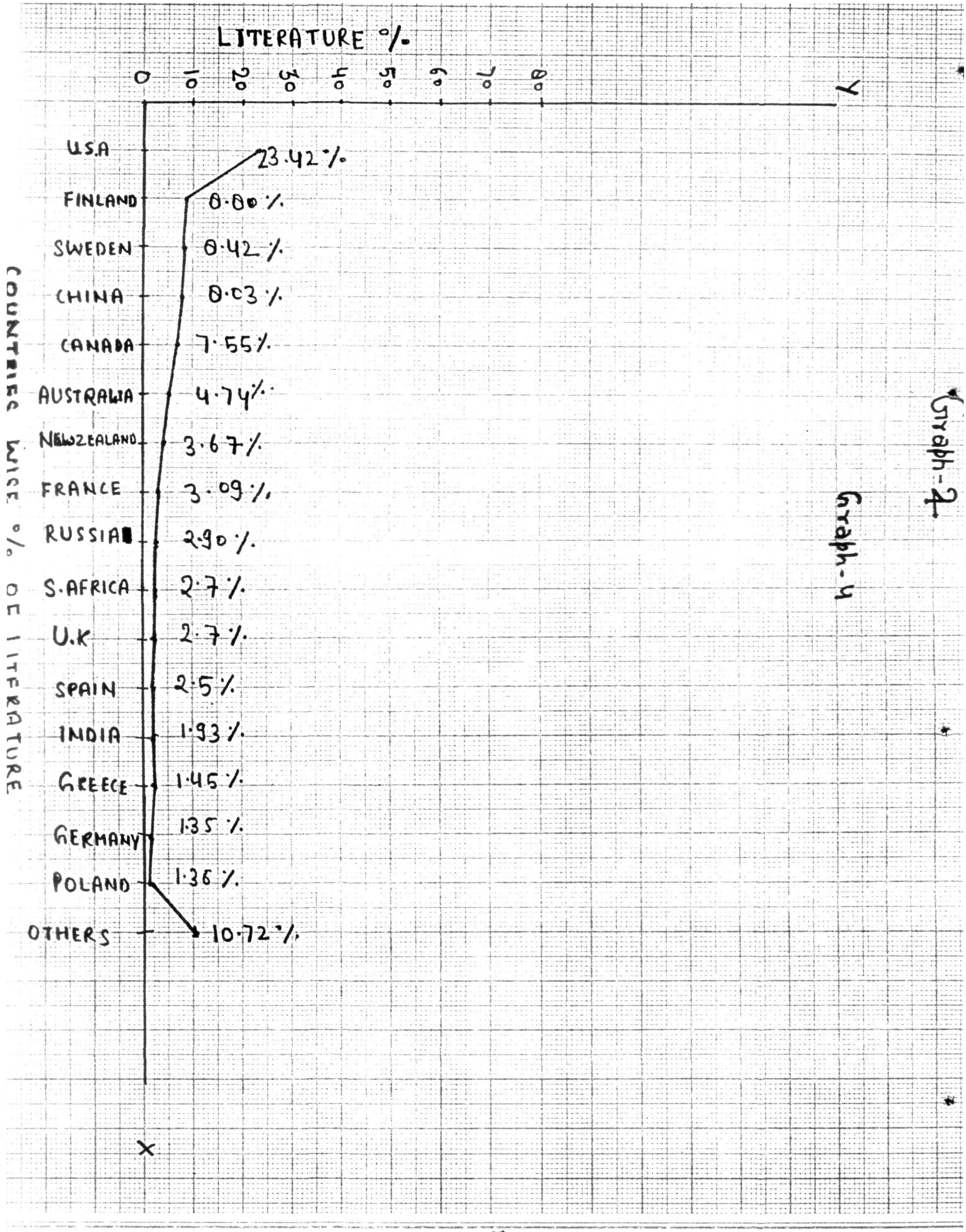
S.No.	Rank	Language	Frequency	Percentage
1.	I	ENGLISH	173	77.92
2.	II	CHINESE	20	9.00
3.	III	KOREAN	9	4.05
4.	IV	RUSSIAN	6	2.70
5.	V	FRENCH	3	1.35
6.		OTHERS	11	4.95
			222	**100%**

TABLE 3.3 LANGUAGE DISTRIBUTION OF YEAR 1996

S.No.	Rank	Language	Frequency	Percentage
1.	I	ENGLISH	165	84.6
2.	II	CHINESE	12	6.15
3.	III	FRENCH	5	2.56
4.	IV	KOREAN	4	2.05
5.	IV	RUSSIAN	4	2.05
6.		OTHERS	5	2.56
			195	100%

TABLE 3.4 LANGUAGE DISTRIBUTION OF YEAR 1997

S.No.	Rank	Language	Frequency	Percentage
1.	I	ENGLISH	163	81.09
2.	II	CHINESE	21	10.44
3.	III	FRENCH	8	3.98
4.	IV	KOREAN	6	2.98
5.	V	OTHERS	3	1.49
			201	100%


LITERATURE %
0
10
20
30
40
50
60
70
80
Y
X
COUNTRIES WISE % OF LITERATURE
U.S.A
23.42 %
FINLAND
0.00 %
SWEDEN
0.42 %
CHINA
0.03 %
CANADA
7.55 %
AUSTRALIA
4.74 %
NEWZEALAND
3.67 %
FRANCE
3.09 %
RUSSIA
2.90 %
S.AFRICA
2.7 %
U.K
2.7 %
SPAIN
2.5 %
INDIA
1.93 %
GREECE
1.45 %
GERMANY
1.35 %
POLAND
1.36 %
OTHERS
10.72 %
Graph-2
Graph-4

E

DIAGRAM-10

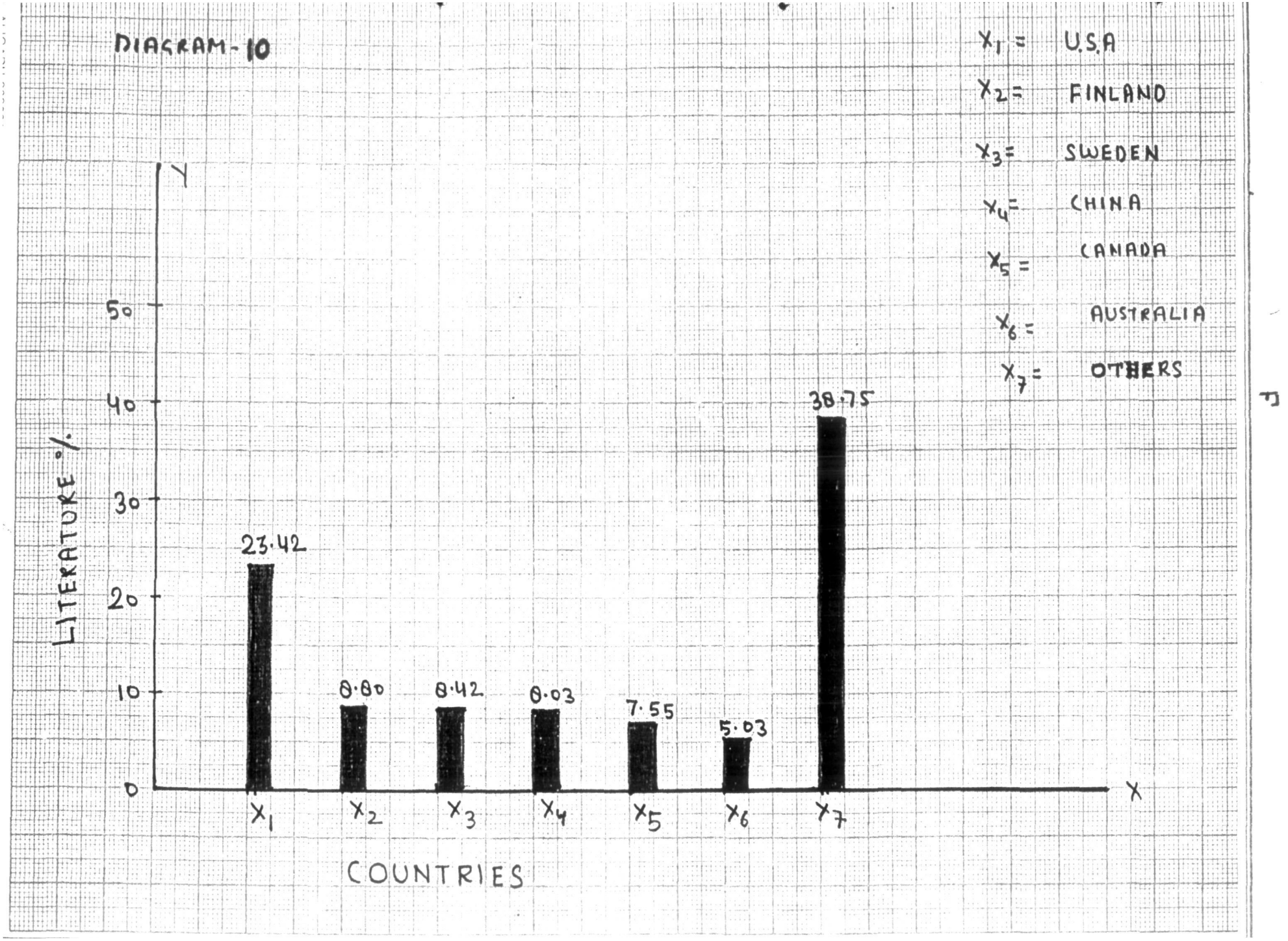

X1 = U.S.A
X2 = FINLAND
X3 = SWEDEN
X4 = CHINA
X5 = CANADA
X6 = AUSTRALIA
X7 = OTHERS
Y
X
LITERATURE %
50
40
30
20
10
0
23.42
8.80
8.42
8.03
7.55
5.03
38.75
X1
X2
X3
X4
X5
X6
X7
COUNTRIES

TABLE 3.5 LANGUAGE DISTRIBUTION OF YEAR 1998

S.No.	Rank	Language	Frequency	Percentage
1.	I	ENGLISH	157	82.19
2.	II	CHINESE	12	6.28
3.	III	FRENCH	7	3.66
4.	IV	RUSSIAN	5	2.6
5.	V	KOREAN	4	2.09
6.		OTHERS	6	3.14
			191	100%

4. COUNTRYWISE DISTRIBUTION OF PAPERS OR GEOGRAPHICAL DISTRIBUTION OF PAPERS

Country wise distribution of papers are given in table 4. It is clear from Table 4 that nearly 23.42% papers emerge from U.S.A., so here out of 1033 papers, USA contributed 242 papers in five years and that have got first rank in the table. Finland have second place in the table having 8.80% papers in five year (91). and Sweden, China, Canada , Australia has got 3,4, 5,6 like it India has got 13th place in the table, So in table 4 these country have higher productivity (rank) in the research field on pines plant. (Forestry products). The other country contributing articles in the distribution of papers got next rank in the table. In the table 4 countrywise distribution of papers are

represented in a diagrammatic or graphic form out of the total percentage of literature on pines, India has 1.93% literature in five years.

Table - 4

GEOGRAPHICAL DISTRIBUTION OF PAPERS IN FIVE YEAR- According to countries

S./ No	Countries	Rank	1994	1995	1996	1997	1998	Total	%
1.	USA	1	55	40	45	52	50	242	23.42
2.	FINLAND	2	18	17	20	15	21	91	8.80
3.	SWEDEN	3	20	20	15	16	16	87	8.42
4.	CHINA	4	13	21	16	20	13	83	0.03
5.	CANADA	5	18	17	15	14	13	78	7.55
6.	AUSTRALIA	6	14	15	8	5	10	52	5.03
7.	NZ.LAND	7	10	8	9	15	7	49	4.74
8.	FRANCE	8	7	10	7	6	8	38	3.37
9.	RUSSIA	9	10	8	5	4	5	32	3.09
10.	S. AFRICA	10	6	5	5	7	7	30	2.90
11.	S. KOREA	11	4	9	3	6	6	20	2.7
12.	UK	11	4	5	5	7	7	28	2.7
13.	SPAIN	12	5	5	6	5	5	26	2.5
14.	INDIA	13	3	7	5	2	3	20	1.93
15.	GREECE	14	3	4	2	4	2	15	1.45
16.	GERMANY	15	4	1	4	3	2	14	1.35

Continued

Continued

S./ No	Countries	Rank	1994	1995	1996	1997	1998	Total	%
17.	POLAND	16	5	1	1	3	2	12	1.16
18.	ITALY	17	1	5	1	2	1	10	0.96
19.	MEXICO	17	4	2	2	1	1	10	0.96
20.	BULGARIA	17	3	3	2	--	2	10	0.96
21.	ROMANIA	18	3	1	1	7	1	7	0.67
22.	TANZANIA	18	1	2	3	--	1	7	0.67
23.	BRAZIL	18	4	1	1	1	--	7	0.67
24.	PARIS	19	1	2	2	--	1	6	0.58
25.	KENYA	19	1	1	1	1	2	6	0.58
26.	NET.LAND	20	--	2	1	2	--	5	0.48
27.	TURKEY	20	1	2	1	1	--	5	0.48
28.	DREN MARK	20	--	1	1	1	2	5	0.48
29.	NIGERIA	21	1	1	--	1	1	4	0.38
30.	ISRAEL	21	--	1	1	1	1	4	0.38
31.	ARGENTINA	22	--	1	1	1	--	3	0.29
32.	PURHA	22	1	1	1	--	--	3	0.29
33.	PAKISTAN	23	1	--	--	1	--	2	0.19
34.	ALGERIA	23	1	--	1	--	--	2	0.19
35.	BELARUSS	23	1	1	--	--	--	2	0.19
36.	NORVAY	23	--	--	--	1	1	2	0.19
37.	SWEIZLAND	23	--	1	1	--	--	2	0.19
38.	PURTGAL	23	--	--	1	1	--	2	0.19
39.	INDONESIA	23	1	--	1	--	--	2	0.19
40	THAILAND	23	--	1	1	--	--	2	0.19
41.	B.DESH	24	--	--	--	1	--	1	0.09
			224	**222**	**195**	**201**	**191**	**1033**	**100%**

5. RANKING LIST OF JOURNALS

The ranking list is essentially a practical tool designed to help the librarians and research scientists to select the journals of maximum utility in relation to their coverage of articles and important literature in a particular subject area. The present ranked list of Journals is more useful to science field. This list have 132 list of Journals, in all the six journals are more productive. These six have contain 41.91% literature and got 1 to 6 ranks in the Table 6. In this list ranking, %, Frequency of papers, name of journals are given so by this the ranking of periodicals easily known.

TABLE 6 RANKING LIST OF PERIODICALS

S. No.	Rank	Name of the Journal	Country	1994	1995	1996	1997	1998	Total	%
1.	1	Canadian journal of Forest Res.	Australia	22	25	15	24	15	101	9.77
2.	2	Forest Ecology & management	Finland	20	13	19	15	24	91	8.01
3.	3	Forest Research	China	10	17	11	20	10	68	6.58
4.	4	Silvae Genetica	Finland	17	9	13	12	12	63	6.09
5.	5	Scandinavian journal of Fore. Res.	Sweden	16	11	10	5	15	57	5.51
6.	6	Southern Jour. of Appl. Forestry	U.S.A.	11	6	12	6	18	53	5.13
7.	7	Newzeland Journal of Forestry	Newzeland	8	6	13	15	5	45	4.35
8.	8	New Forests	Canada	7	9	7	7	10	40	3.87
9.	9	Tree physiology	U.S.A	7	8	11	3	4	33	3.19
10	10	Forest Science	Canada	13	7	--	6	6	32	3.09
11	11	South Africa Forestry Journal	S.Africa	4	6	5	7	6	28	2.71
12	12	Plant & Soil	Sweden	3	6	4	11	1	25	2.42
13	13	Silva Fannica	Finland	6	4	4	1	9	24	2.32

Continued

Continued

S. No	Rank	Name of the Journal	Country	1994	1995	1996	1997	1998	Total	%
14.	14	Annals Des Sciences Forestieres	Paris	5	4	1	7	6	23	2.22
15.	15	Lesovendenie	Russia	10	1	3	3	3	20	1.93
16.	15	Indian Forester	India	3	7	5	2	3	20	1.93
17.	16	Jur. of Korean Forestry Society	Korea	3	8	3	3	2	19	1.83
18.	17	Western Journal of Applied Forestry	USA	1	1	2	4	3	11	1.06
19.	18	Tree (Berlin)	Berlin	2	1	1	3	3	10	0.96
20	18	Revue Forestiere Francise(Nancy)	Nancy	1	2	2	3	2	10	0.96
21.	18	Res.Rep.of the For. Gen. Res. Inst.	Korea	2	5	1	3	1	10	0.96
22.	19	Journal of Tropical Forest Science	Culumbia	3	3	2	1	--	9	0.87
23.	20	Scottish Forestry	U.K.	--	1	2	1	4	8	0.77
24.	21	Byullete Ten Moskovskogo Obstichistva Lspytalelei Prirody Otdel Biologiehiski	Russia	--	--	7	--	--	7	0.67
25.	22	Northern Jur. of Applid Forestry	USA	1	3	1	--	1	6	0.58
26.	22	Nauka Za Gorata	--	--	--	--	3	3	6	0.58
27.	22	Environmental Pollution	USA	--	4	--	--	2	6	0.58

Continued

Continued

S. No	Rank	Name of the Journal	Country	1994	1995	1996	1997	1998	Total	%
28.	22	Seed Science and Technology	Italy	2	2	1	1	--	6	0.58
29.	22	Agroforestry Systems	Newzealand	1	2	1	2	--	6	0.58
30.	22	Forestry (Oxford)	Oxford	1	1	3	1	--	6	0.58
31.	22	Mycorrhiza	Netherland	--	2	1	3	--	6	0.58
32.	23	Quebec Min. Des Forest	---	--	1	--	4	--	5	0.48
33.	23	Yingyong Shergtai Xuebao	China	--	2	2	1	--	5	0.48
34.	23	Lesnictvi (Prague)	Parague	1	1	1	1	1	5	0.48
35.	23	Soil Sc. Soc. of America Jur.	U.S.A.	1	1	1	2	--	5	0.48
36.	23	Annals Dell Inst. Spe. Per. Sel.	Italy	--	4	--	1	--	5	0.48
37.	24	Annals of Botany	London	1	--	3	--	--	4	0.38
38.	24	Interciencia (Mexico)	Mexico	4	--	--	--	--	4	0.38
39.	24	Acta Univ. Qualuensis Series	Finland	1	2	--	--	1	4	0.38
40.	24	U.S. Forest Ser. Res. Paper RNW	U.S.A.	1	1	--	--	2	4	0.38
41.	24	Int. Jur. of Wildland Fire	Spain	--	--	3	1	--	4	0.38

Continued

S. No	Rank	Name of the Journal	Country	1994	1995	1996	1997	1998	Total	%
42.	24	Suo (Helsinki)	Helsinki	2	1	1	--	--	4	0.38
43.	24	Aus. Jur. of Expr. Agriculture	Australia	--	2	2	--	--	4	0.38
44.	24	Plant Cell and Environment	U.S.A.	1	1	1	1	--	4	0.38
45.	25	Theoritical & Applied Gen.	----	1	--	1	--	1	3	0.29
46.	25	Canadian Jur. of Soil Science	Canada	1	--	--	--	2	3	0.29
47.	25	Water Air & Soil Pollution	Canada	2	--	--	1	--	3	0.29
48.	25	In Vitro Cellular & Dev. Biol. Pl.	Italy	--	1	2	--	--	3	0.29
49.	25	Rastitel Nve Resursy	Russia	--	3	--	--	--	3	0.29
50.	25	Bioset Forests Des Tropiques	----	--	2	1	--	--	3	0.29
51.	25	Aus. Jur. of Soil Research	Australia	--	2	--	1	--	3	0.29
52.	25	Canadian Jur. of Botany	Canada	--	2	--	--	1	3	0.29
53.	25	Jur. of Plant Resource & Envir.	China	--	--	1	1	1	3	0.29
54.	26	Biological Bulletin of Poznan	Poland	2	--	--	--	--	2	0.19
55.	26	Bulletin OEPP	U.S.A.	2	--	--	--	--	2	0.19

Continued

S. No	Rank	Name of the Journal	Country	1994	1995	1996	1997	1998	Total	%
56.	26	Biomass & Bioenergy	U.K.	1	--	--	--	1	2	0.19
57.	26	Biology & Fetility of Soils	Finland	2	--	--	--	--	2	0.19
58.	26	Soil & Crop Sc. Society	F.L.A.	--	2	--	--	--	2	0.19
59.	26	E Kologiya	Moscow	--	1	--	1	--	2	0.19
60.	26	Journal of Plant Nutrition	France	--	1	--	1	--	2	0.19
61.	26	Eropian Jur. of Forest Pathology	Finland	--	1	--	--	1	2	0.19
62.	26	Soil Biol. & Biochem.	India	--	1	--	--	1	2	0.19
63.	26	Australian Jur. of Physiology	Australia	--	2	--	--	--	2	0.19
64.	26	Journal of Hydrology	N.Z.	--	1	1	--	--	2	0.19
65.	26	New Phytologist	U.S.A.	--	1	1	--	--	2	0.19
66.	26	Journal of Chemical Ecology	Finland	--	--	1	--	1	2	0.19
67.	26	Acta Forestalia Fannica	Finland	--	--	1	1	--	2	0.19
68.	26	Jur. of Analyticsal & App. Pyrolysis	----	--	--	--	2	--	2	0.19
69	26	US-For. General of Tech. Rep. NNW	U.S.A.	--	--	--	2	--	2	0.19
70.	26	Plant Ecology	Spain	--	--	--	--	2	2	0.19
71.	27	Others (62. Journals)		22	12	12	9	8	63	6.38
				224	**222**	**195**	**201**	**191**	**1033**	**100%**

Continued

5.1 BRADFORD'S LAW OF SCATTERING AND PINES LITERATURE

The data obtained in the analysis was put to test the law of scattering accordingly graph was plotted taking cumulated sum of articles R(h) on the ordinate X axis versus of the cumulated sum of journals on the Y-axis.

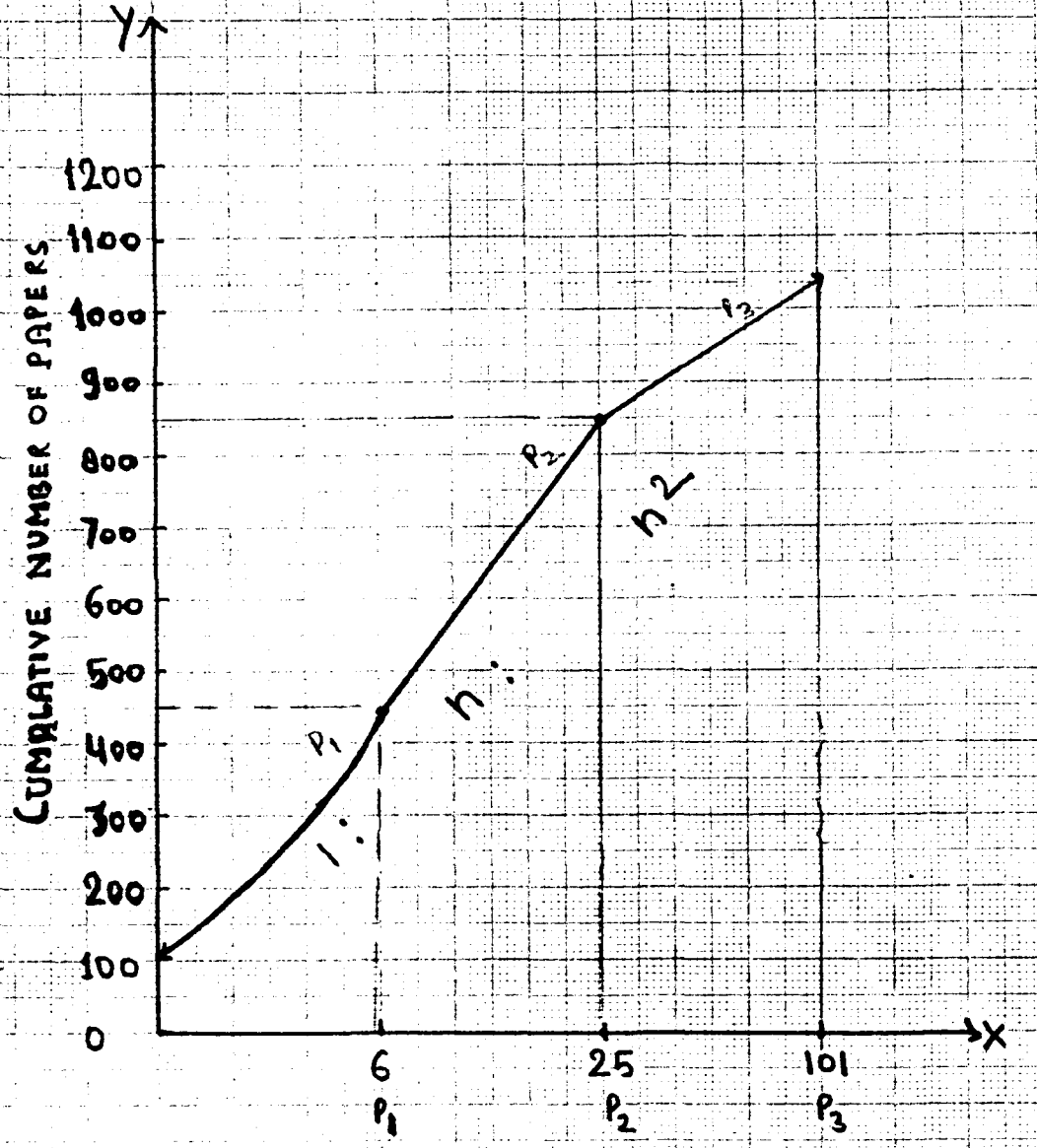
An initially rising and then turning into a liner curve was obtained, which is in accordance with Bradford's hyperbolic curve therefore, it can be said that subject is highly growing.

Ranking of Periodicals

It is clear from the table that in all 132 journals only 6 journals are core or nucleus, their six journals contain 41.9 Literature from 100% literature These six journals containing 433 articles from the total of 1033 in the five years study of Pines plants.

According to Bradford's law or equation

GRAPH-5



No. OF JOURNALS

Brad Ford's Bibliograph.

$1 : n : n_2$

$\frac{1}{p_1} : \frac{n}{p_2} : \frac{n_2}{p_3}$

$\frac{p_1}{6} : \frac{p_2}{6x4} : \frac{p_2}{6x4x4}$

Zone $p_1 = 6$

Zone $p_2 = 25$

Zone $p_3 = 101$

From this equation the core journal easily search here in this case the core journal containing Zone p_1 = 6 and related journal Zone p_2 is containing 25 journals and Zone p_3 is containing 101 journals.

TABLE 5

RANKING OF PERIODICALS

No. of Zones	Number of Journals	Frequency of papers	Cumulative No. of Papers	%
p_1	6	433	433	41.91
p_2	25	416	849	40.27
p_3	101	184	1033	17.81
	132	1033	1033	100%

5.2 RANKING LIST JOURNALS OF ACCORDING TO MODIFIED BRADFORD LAWS

TABLE 6

Zone	No. of periodicals	No. of articles	Cumulative NO. articles	Percentage
P1	3	260	260	25.16
P2	5	298	518	50.14
P3	124	515	1033	100%

From the table 6 - It is clear that zone P1 contains 25% articles and P2 zone contains 50% articles and last P3 contains 100% so by this table the modified Bradford's law is broadly proved.

6. RANKING OF AUTHORS & LOTKA'S LAW OF SCIENTIFIC PRODUCTIVITY:

In this list the ranking of author of five year (1994 to 1998 is given table provide alternative value about the ranking of authors. When we compare this rank to Lotka's law $1/n_2$ then we find that this law is not fulfill completely.

TABLE 7 FOR MORE RANKED AUTHOR OF FIVE YEAR(1994-98)

S.N.	Author' Name	Contributed Papers	Ranked
1.	BURKHART (HaroldE)	16	I
2.	GUOFENG (Qin)	12	II
3.	MEAD (DJ)	10	III
4.	SHELTON (MichaelG)	10	III
5.	ALLEN (H. Lee)	9	IX
6.	VALLINGER (Erik)	9	V
7.	WRIGHT (JA)	8	V
8.	CHAIN (MichaelD)	8	V
9.	SOUTH (David D)	7	VI
10.	FLODGE(GR)	7	VI
11.	HAYWOOD (JD)	6	VII
12.	DVORAK (WS)	6	VII
13.	ZHOU (Z)	6	VII
14.	WANG (Pedi)	6	VII
15	PIKKULA (Timo)	6	VII

From this table rank of more productive author is clear, but this list does not fulfill the law of law of Lotka because in modern time the joint authorship is increasing but in earlier time joint authorship was small.

RANKING OF AUTHORS IN FIVE YEAR (1994 TO 1998)

Table - 8

S.No.	Rank	No. of Authors	Contributing	%
1.	I	1	16	0.05
2.	II	1	12	0.05
3.	III	2	10	0.11
4.	III	2	9	0.11
5.	III	2	8	0.11
6.	III	2	7	0.11
7.	IV	5	6	0.28
8.	V	10	5	0.57
9.	VI	25	4	1.44
10.	VII	55	3	3.14
11.	VIII	180	2	10.36
12.	IX	1450	1	83.52
		1736	1736	100%

8.1 RANKING OF AUTHORS IN 1994

S.No.	Rank	No. of Authors	Contributing papers	Percentage
1.	I	1	5	0.23
2.	II	1	4	0.23
3.	III	6	3	1.40
4.	IV	52	2	12.17
5.	V	367	1	85.94
				100%

8.2 RANKING OF AUTHORS IN 1995

S.No.	Rank	No. of Authors	Contributing papers	Percentage
1.	I	1	5	0.22
2.	II.	1	4	0.22
3.	III	5	3	1.13
4.	IV	51	2	11.17
5.	V	381	1	86.78
				100%

8.3 RANKING OF AUTHORS IN 1996

S.No.	Rank	No. of Authors	Contributing papers	Percentage
1.	I	1	5	0.28
2.	II	1	4	0.28
3.	III	6	3	1.73
4.	IV	57	2	16.52
5.	V	280	1	81.15

100 %.

TABLE 8.4 RANKING OF AUTHORS IN 1997

S.No.	Rank	No. of Authors	Contributing papers	Percentage
1.	I	2	5	0.47
2.	II	1	4	0.23
3.	III	9	3	2.15
4.	IV	40	2	9.56
5	V	366	1	87.55

100 %.

TABLE 8.5 RANKING OF AUTHORS IN 1998

S.No.	Rank	No. of Authors	Contributing papers	Percentage
1.	I	1	5	0.25
2.	II	2	4	0.51
3.	III	3	3	0.77
4.	IV	53	2	13.73
5.	V	74	1	84.71

100%

7. RANKING LIST OF INSTITUTIONS

This study of Bibliometric analysis on Pines contains list of 513 institutions of the world., 5 year studies of pines literature. In this list the first rank is given to a Chinese institution which provided 30 articles in five year (1033) and second rank to Newzealand institution which provided 29 articles. In this case the rank is not got by the institution of the country with highest articles but it provide that . This institution is more productive in this field. So here the rank of institution is different In this list institutions of Sweden, Finland, USA, have got III, IV, V ranks.

TABLE- 9 FOR RANKING OF INSTITUTION IN FIVE YER (1994-98)

S. No.	Rank	**Name of Institutions.**	**Countries**	**1994**	**1995**	**1996**	**1997**	**1998**	**Total**
1.	1	Research Insst. Subtropical Forest, CAF Fyung	China	5	10	2	9	4	30
2.	2	Newzealand For. Res. Institute Rotoura	NewZealand	6	4	7	10	2	29
3.	3	Swedish Univ. Agri. Sci. Fac. Foresty	Sweden	10	3	6	4	2	25
4.	3	USDA Forest Service, For. Exp. Stn. Forestry Science. Lab.Green Stn. Athens	U.S.A.	14	5	2	3	1	25
5.	4	Finish Forest. Res. Inst. Rovaniemi	Finland	5	4	5	5	5	24
6.	5	USDA Forest Serv. Southern Res. Stn. Mobtiullo	U.S.A.	6	2	2	3	10	23
7.	6	Dep. forestry N.C. State Univ. Raleigh N.C.	U.S.A.	1	6	3	5	3	18
8.	7.	Forest Gentetic Res. Inst. Suwon	S. Korea	2	1	1	4	7	15
9	8	Quensland Forest Res. Inst. Traey	Australia	2	5	2	3	2	14
10	9	Sch. Forestry Auburn univ.	U.S.A.	1	2	2	1	7	13
11.	10	Daniel b. Warnell Sch. Forest GA	U.S.A.	0	1	7	1	3	12

Cont.

Continued

12.	11	Dep. Forest Genetic Plant Physiol Swedish Univ.	Sweden	2	2	3	2	2	11
13.	11	Dep. for. Ecol Univ. Helsinki	Finland	3	3	1	2	2	11
14.	11	Finish Forest Res. inst. Vantaa	Finland	1	3	4	1	0	11
15.	12	Res. Inst. Subtrop. For. province	China	1	7	2	0	0	10
16.	13	Finland Res. Inst. Punkakorya. Res. Stn.	Finland	1	3	4	1	0	9
17.	13	Dep. Foresty Va. Polytectnic Inst. & State Univl Blackborg	U.S.A.	2	3	1	2	0	9
18.	14	B.C. Mini. of Forest Res. Branch Victoria	Canada	0	3	2	3	0	8
19.	15	National Resources For. Ser. Quebie	Canada	0	1	3	3	0	7
20.	15	CSIRO DIV. For. Prod. Mountgambier	Australia	2	0	0	0	5	7
21.	16	Sch. For. Res. Conser. Univ. FLA	U.S.A.	3	1	2	0	0	6
22.	16	INRA Lab. Crossance. Prod.	France	3	3	0	0	0	6
23.	16	V.N. Sukachev Inst. For. Sil. Dep.	Russia	2	2	0	1	1	6
24.	16	Forest Res. Inst. Guizhou	China	0	0	2	4	0	6

In others 525 articles contains 441 institutioins, in these institutions 84

Continued

25.	16	Univ. Joensun Fac. Foresting	Finland	3	1	0	2	0	6
26.	16	Res. Inst. Forest CAF Beiging	China	0	0	2	4	0	6
27.	16	Swedish Univ. umea	Sweden	1	2	3	0	2	6
28.	17	Dep. Forest Soil, Swedish Univ. Agri. Sci. Uppsala	Sweden	0	0	0	4	1	5
29.	17	Dip. For. Sci. Oregon State Univ.	USA	2	1	2	0	0	5
30.	17	CSIRO Div. Forestry Victoria	Australia	1	2	0	2	0	5
31.	17	State Univ. N.V.	USA	1	0	2	1	1	5
32.	17	Dep. Plant Sci. Lincoln Univ.	N.Z.	1	1	0	0	3	5
33.	18	Forestry Can., Petowaea Natl. Forestry Inst.	Canada	3	1	0	0	0	4
34.	18	Central Rechem. Biologic Forest Univ.	Canada	1	0	0	0	3	4
35.	18	2700 rue Einstein State Sainte. Fay	Canada	0	0	0	4	0	4
36.	18	Dip. Genetic Adam Mukiewicz Univ.	Poland	3	0	0	1	0	4
	18	Agnon.Dep. Okla. State Univ.	USA	1	1	1	0	1	4

Continued

Continued

37.	18	USDA For. Serv. Southern Res. Stn. For. Sci. Lab Mobtiullo.	USA	1	0	0	2	1	4
38.	18	Pacific Southwest Res. Stn. For. Ser.	USA	2	0	0	2	0	4
39.	18	Forestry Res.. Inst. Glunten Uppsde	Sweden	4	0	0	0	0	4
40.	18	Swedish univ. Agri., Sci. Umea	Sweden	0	3	1	0	0	4
41.	18	Kenya Forestry Res. Inst.	Kenya	0	0	1	1	2	4
42.	18	Eqliepe Phytoecologie unite de' ewphysiblogic Forestere Inra Hancy	France	0	0	0	1	3	4
43.	18	Inst. For. Karel. Sci. Cent. Russ. Acad. Sci.	Russia	0	2	1	0	1	4
44.	18	Dep. Biol Vegetal. ETSI Agnonomos	Spain	1	1	0	2	0	4
45.	19	Finish Forest Res. Inst. Vanta.	Finland	0	1	1	1	0	3
46.	19	Finish Forest Res. Inst. Kolari	Finland	0	1	1	1	0	3
47.	19	Dep. Forest-Ecol Unionin Katwuo	Finland	0	0	1	1	1	3

Continued

Continued

48.	19	Dep. Bio. /Bot. Univ. Qulu	Finland	0	0	0	0	3	3
49.	19	Coll Forestry Res. Envi. Nanjing	China	0	0	0	1	2	3
50.	19	Bio Veg. UNESP. Rioclaro Brazil	Brazil	3	0	0	0	0	3
51.	19	Forest Res. Inst. sofia, Bulgaria	Bulgaria	0	3	0	0	0	3
52.	19.	Oxford For. Inst. Plant Sci. univ.	UK	0	0	1	2	0	3
53.	19	Forestry Commission Technol. Dev. Branch	UK	0	0	1	0	2	3
54.	19	Nat. Agri. Res. Found. For. Res. Inst. Terma	Greece	1	0	1	0	1	3
55.	19	Dep. For. Wild Life Resour. Virginia	USA	0	0	1	2	0	3
56	19	Dip. of Bot. Duke Univ. durthan M2770 USA	USA	0	0	1	2	0	3
57	19	Boyce Thormpson Inst. Plant Res. Cornell. Univ. Tower Thacea	USA	0	0	0	1	2	3
58	19	Faculty of Forestry, Univ. Stellenbosch Matieland	S. Africa	0	0	3	0	0	3
57	19	North east Cope For. SA	S. Africa	0	0	0	0	3	3

Continued

Continued

58	19	Plant. for. Res. Cent. CSIRO. Div.	Australia	0	3	0	0	0	3
59	19	Pacific Forestry Cent. National Resources	Canada	3	0	0	0	0	3
60	19	Dep. For. Sci. Fac. Fore. Univ. British Columbia	Canada	3	0	0	0	0	3
61	19	Canadian For. Ser. Inst.	Canada	1	0	0	0	2	3
62	19	Canadian Fors. Ser. Quebue Region	Canada	2	1	1	0	0	3
63	19	Ministry Des. Resources Serv.	Canada	0	1	1	0	1	3
64	19	Smurfit Carton De Columbia AA6974	Canada	0	0	3	0	0	3
65	19	Swedish Univ. Agri. Herrgradsvagin	Sweden	0	0	1	1	1	3
66	19	Skog Forsk, Glunten Uppsala Sweden	Sweden	0	1	0	1	1	3
67	19	Life Ecol., Swedish Univ. Agricultural	Sweden	0	0	2	0	1	3
68	19	Res. Inst. For. Gent. Sel. Verongti	Russia	1	1	0	0	1	3
69	19	Bot. Gard. Inst.	Russia	0	2	0	1	0	3
70	19	Others							

2. CITATION ANALYSIS

Citation analysis is one form of bibliometric analysis. It makes use of bibliographic references which are essential part of the primary scientific communication. The technique of citation analysis involves the process of collection, counting and analysis, interpretation of citations given in various identification of significant source of information, individuals and other aggregate of scientific activities.

CITATION ANALYSIS OF THE CITED DATA

Citation analysis of 174 citations from 18 articles which comes in our A.M.U. in the Department of Botany in some journals.

2.1 DISTRIBUTION OF PAPERS AND CITATION 1994 TO 1998

In distribution of papers we found that 2 papers cited 46 citations in 1994 of Indian Forester and in 1995-4 papers cited 27 references, 1996- 5 papers cited 51 references, 1997-2 papers cited 22 references, 1998-5 papers cited 28 references. From this table 11 is clear that which type of documents are used and it tells us the condition of research.

2.2 TYPE OF DOCUMENT CITED OR RANKING OF SOURCE MATERIALS

Table 10 shows the analysis of citations based on bibliographic forms. For this card are sorted into different categories on the basis of document cited. They are grouped into journals, books, reports, Proceedings, serials, thesis, Bulletins and others. Which do not belong to any of the above groups. This table represent the major sources of references through some other like newspaper articles, patents, standards like, the details of the type of documents consulted by Pines plants researchers are given in table 10.

The study revealed that journals are the preferred source of information (44.25%) Books are found to be less important to them as their percentage of citation was only 13.46%. The reports are less in importance to books it found only 12.64%, proceedings are used in 7.45%, serials, thesis only 3.44%, Bulletins used only 2.87%, other are used 2.87%.

2.3 AUTHORSHIP PATTERN

The table 11 depicts the authorship pattern of the literature out of the total of 174 cited sources - 44% have been produced by a single author. 46% produced by multiple authorship (two authors). This goes to prove that there is hardly any team research even when the work is done jointly

it does not go beyond two though some work has been done by three, beyond this is a rare phenomenon. Also there is no indication that the team work is getting popular with the passage of time.

TABLE - 10

DISTRIBUTION OF PAPERS AND CITATION

Year	No of Papers	No of Reference	Average	Percentage
1994	2	46	23	26.43
1995	4	27	6.75	25.51
1996	5	51	10.20	29.31
1997	2	22	11.0	12.62
1998	5	20	5.60	16.09

100 %.

TABLE - 11

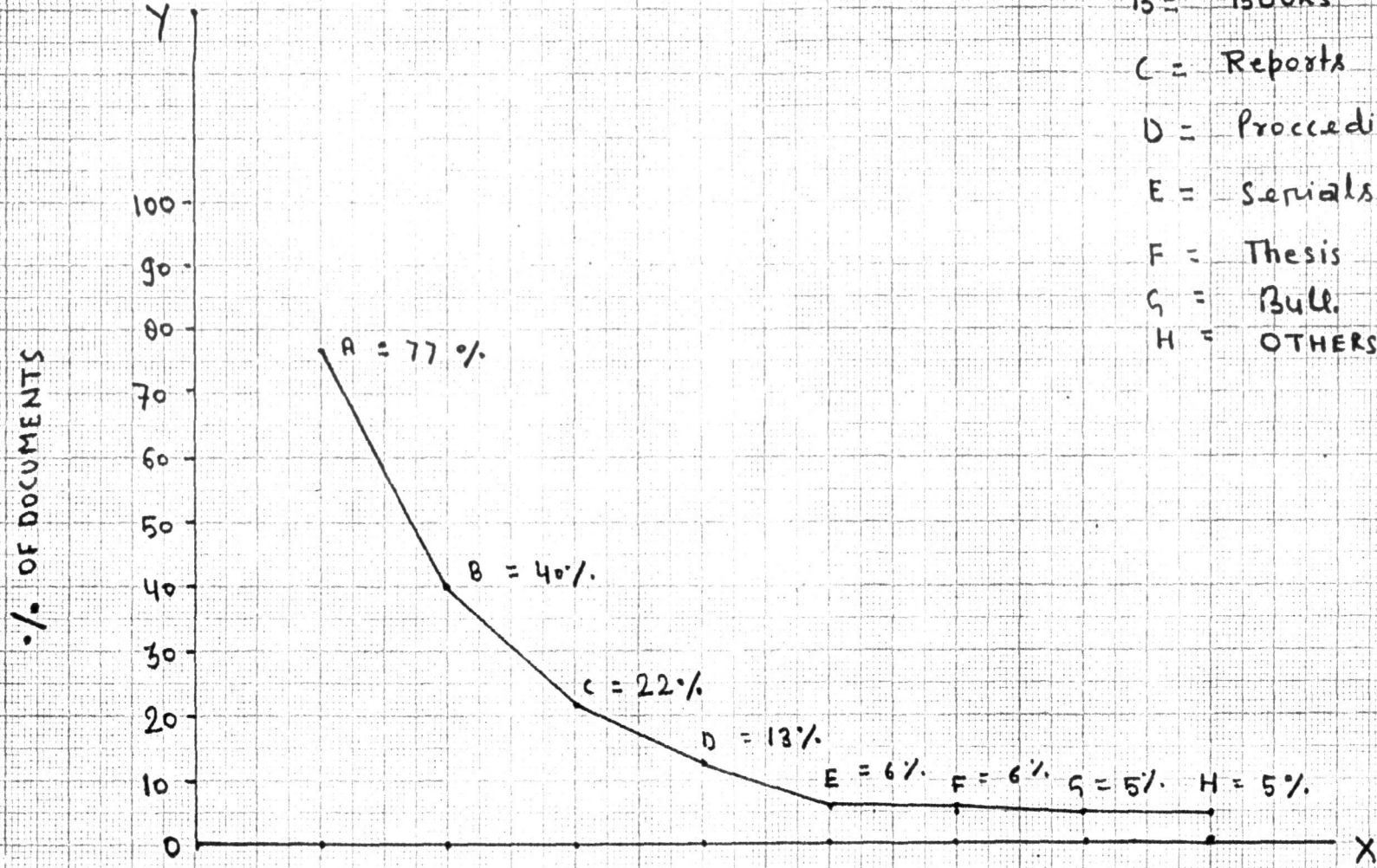
TYPE OF DOCUMENTS CITED

Type of documents	Citations	Percentage
Journal articles	77	44.25
Books	40	22.98
Reports	22	12.64
Proceeding	13	7.47
Serials	6	3.44
Thesis	6	3.44
Other	5	2.87

100 %

Graph-6

A = Journal articles
B = Books
C = Reports
D = Proceedings
E = Serials
F = Thesis
G = Bull.
H = OTHERS



CITED FORM OF DOCUMENTS

Graphic Representation of cited form of document

DIAGRAM . 1 1

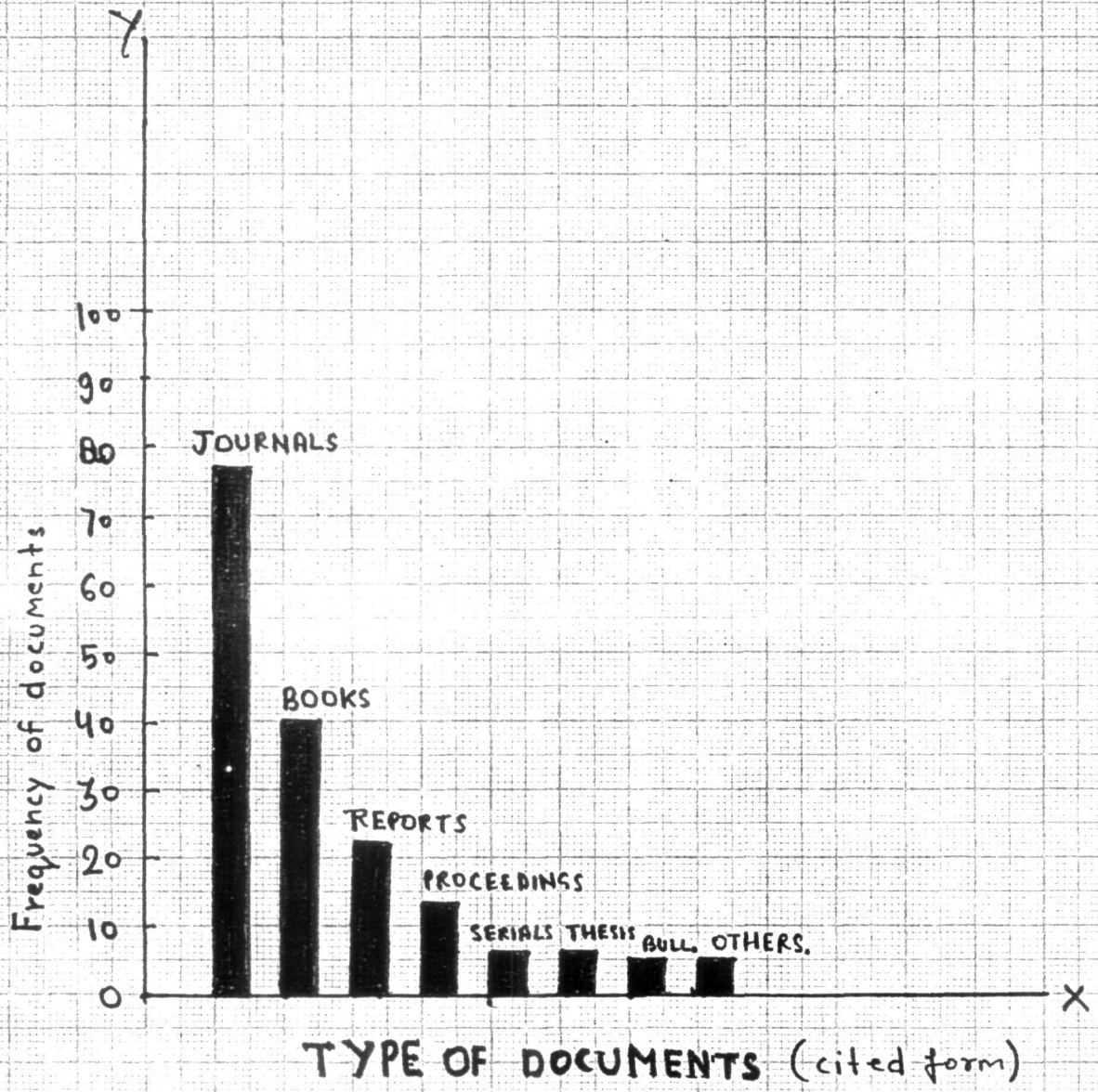


DIAGRAM No.

TABLE - 12

TABLE FOR CITED AUTHORSHIP

Year	Papers	SingleAuth.	%	Joint Auth.	%	Total
1994	2	24	31.16	22	22.68	46
1995	4	8	10.38	19	19.58	27
1996	5	29	37.66	22	22.68	51
1997	2	7	9.00	15	15.46	22
1998	5	9	11.68	19	19.58	28
	18	77	100%	97	100%	174

TABLE - 13

RANKED LIST OF CITED JOURNALS

S.No.	Rank	No. of Journal	Citation	Percentage
1.	1	Indian Forester	11	14.28
2.	2	Journal Forestry	8	10.38
3.	2	N.Z. Jur. For. Res.	8	10.38
4.	3	Canadian Jur.of For. Res.	7	9.00
5.	4	Forest Science	5	6.49
6.	5	Aust. Jur. Botany	3	3.89
7.	5	Jur. of Applied Ecology	3	3.89
8.	6	Journal of Ecology	2	2.59
9.	6	Europian Jur. of For. Path.	2	2.59
10.	6	Silva Genetica	2	2.59
11.	6	Scand. Jur. of For. Res.	2	2.59
12.	6	Plant Soil	2	2.59
13.	7	Other Journals	22	28.57
			77	100%

2.4 RANKING LIST OF CITED JOURNALS

The 77 journal articles obtained from 18 papers are analysed in detail. In the citation analysis the most frequently used journals by Indians are Indian Forester, Journal Forestry, Newzealand Journal of Forest Research, which have I, II, III ranks in the list of periodicals.

The given table contains 34 Journals in all only 12 Journals have more than one frequency and in 22 Journals only one paper was cited by the study of citations. Here only 12 Journal contains 71.42% articles and 22 Journals contains 28.57% only. So ranking of cited journals clear from the view, that which journal is more productive.

2.5 RANK LIST OF AUTHORS

The table 14 contain 21 authors list who are contributing more than one paper. In the following table first rank was also got one author and 4 authors have got III rank, contributing by 18 authors. This ranking list of authors was analysed from the papers citations.

2.6 DISTRIBUTION OF CITED YEARS

In citation Analysis total 35 years cited, in all 35 years, 1982 got first rank in the table 15 as the most cited year. And 1977, 1986 have second rank. This data shows the research value of year and which year is more productive.

TABLE 14 FOR RANKING OF AUTHOR AND JOINT, SINGLE AUTHORHIP PATTERNS

S. No.	Rank	Authors	Single	Joint	1994	1995	1996	1997	1998	Total
1.	I	NEBERKER (TF)	--	5	5	--	--	--	--	5
2.	II	VALINGER (E)	2	2	--	--	4	--	--	4
3.	III	SINGH (RB)	--	3	--	1	1	--	1	3
4.	III	SPUOR (SH)	2	1	3	--	--	--	--	--
5.	III	HODGES (JD)	--	3	3	--	--	--	--	3
6.	III	BURKHART (HE)	1	2	3	--	--	--	--	3
7.	IV	EVANS (Julian)	2	--	--	--	--	1	1	2
8.	IV	DEGERMARK (C)	2	--	--	--	2	--	--	2

Cont.

Cont.

9.	IV	CHAMPION (HG)	--	2	--	--	2	--	--	2
10.	IV	DAS (BL)	1	1	--	--	1	--	1	2
11.	IV	KHANDURI (DL)	--	2	--	1	--	--	1	2
12.	IV	SETH (SK)	--	2	--	--	2	--	--	2
13.	IV	DANIELS (RE)	1	1	2	--	--	--	--	2
14.	IV	JOLLIFFE (PA)	1	1	2	--	--	--	--	2
15.	IV	HOWKSWORTH (FG)	1	1	2	--	--	--	--	2
16.	IV	VAMDORSSER (JC)	1	1	--	2	--	--	--	2
17.	IV	ROOK (DA)	2	--	--	--	2	--	--	2
18.	IV	LAMB (AFA)	2	--	--	--	1	--	--	2
19.	IV	HEGGI (F)	2	--	2	--	--	--	--	2
20.	IV	DONALD (DGM)	--	2	--	--	1	--	1	2
21	IV	SUNDBERG(B)	2	--	--	--	2	--	--	2
			22	**29**	**19**	**4**	**18**	**1**	**6**	**51**

TABLE 15- FOR AGE OF CITATIONS, CITED IN THE PAPERS

S.No.	Rank	Cited year	Frequency	Percentage
1.	1	1982	18	10.34
2.	2	1977	14	8.40
3.	2	1986	14	8.40
4.	3	1983	13	7.47
5.	4	1979	12	6.89
6.	5	1990	11	6.32
7.	6	1984	10	5.75
8.	6	1987	10	5.74
9.	6	1989	10	5.74
10.	7	1993	9	5.71
11.	8	1969	8	4.59
12.	8	1976	8	4.59
13.	8	1980	8	4.59
14.	9	1994	7	4.02
15.	9	1992	7	4.02
16.	10	1970	6	3.44
17.	10	1974	6	3.44
18.	10	1975	6	3.44
19.	10	1985	6	3.44
20.	10	1988	6	3.44

Cont.

Continued

21.	10	1994	6	3.44
22.	11	1987	5	2.87
23.	11	1952	4	2.29
24.	11	1967	4	2.29
25.	12	1973	4	2.29
26.	12	1939	3	1.72
27.	12	1948	3	1.72
28.	12	1962	3	1.72
29.	12	1968	3	1.72
30	12	1995	3	1.72
31.	13	1934	2	1.14
32.	13	1940	2	1.14
33.	13	1950	2	1.14
34.	13	1972	2	1.14
35.	14	Others	15	8.62
			174	100

2.7 HALF LIFE PERIOD

From the table it is clear that total 52.82% cited material comes from 12 years out of 35 years i.e. only 12 years provides approximately 50%. Literature ranking of cited year also given in the table of cited year.

TABLES 16 FOR HALF LIFE PERIOD CITED LITERATURE

S.NO.	Period	Number of Citation	Percentage
1.	1995	3	1.72
2.	1954	4	2.29
3.	1953	9	5.17
4.	1992	7	4.02
5.	1991	7	4.02
6.	1990	11	6.32
7.	1989	11	5.74
8.	1988	6	3.44
9.	1987	5	2.87
10.	1986	14	8.04
11.	1985	6	3.44
12.	1984	10	5.77
		89	52.82%

From this table 14 it is clear that total 174 citation come from 35 years but when I have done Half life period study then found, only 12 year (1984 to 1995) citation contain 52.84% literature out of 100% literature. So from this table it is clear that half life cited years are more productive for literature use.

2.8 CO-CITATION: - In citation Analysis only four documents co-cited in two times in 18 papers citations. So these four document are more close in comparison to other

3. ANALYSIS

BRADFORD'S LAW OF SCATTERING AND DATA ANALYSIS

In the present data the Bradford's law can not be completely proved as in modern times the productivity of periodicals are changing because the fusion of subjects have a tremendous growth so new subject are developing and so scattering is also being effected.

MODIFIED BRADFORD'S LAW:- In second place analysis this law is broadly proved in case of number of articles.

In this case we found out three zone also P1; P2; P3.

In P1 zone, 3 journals contains 260 articles and P2 zone 5+3 journals contain 260 + 258 = 518 articles (50%) and last zone contain 518 + 515 = 1033 (100%) articles . So a according to Bradford's law

1: n: n2

260/1, 260 x 2/n, n = 520 260 x 2 x 2/ n2 = 1040

And the Actual data are :

P1 = 260 P2 = 518 and P3 = 1033

So in the case of articles the modified law completely proved.

By this analysis, in this case we found out 3 core journals. These, three core journals contains 260 articles out of 1033 and next 5+3 = 8 journals contain 518 articles out of 1033 in P3 zone 124 perdiodicals contains 515 articles only

From the table it is evident that Canadian Journals of Forest Research ranks first with the highest concentration of citation on pine plants. It has 101 articles.

1. Canadian Journal of Forest Research - 101 Articles
2. Forest Ecology & Management - 91 Articles
3. Forest Research - 68 Articles

These 3 journals in the ranked list are having about 1/4th of the articles. These carries 25. 76% (260) articles out of 1033 articles

Only 26 periodicals contains 79.28 literature out of 132 periodicals

26 x 100/ 132 = 19.69% periodicals

These 26 journals contains 819 articles out of 1033 articles

100 x 819/1033 = 79.28% .: **20/80 Law is proved**

INSTITUTIONS

In the Analysis of institution only 30.40% institution produced 65.44% literature out of 100% institutions.

Total institutions are 513

More productive are 156

so 100 x 156/513 = 30.4%

another side

total number of articles are 1033 and 676 articles produced by only 156 institutions , 100 x 767/1033 = 65.44%

Another side 357 institutions produced only 34.50% literature.

100 x 357/513 = 69.59% institution., 100 x 357/1033 = 34.55.%

SECOND LEVEL PERIODICALS

In second level 7(20%) journals contains 45 articles out of 77 articles 100 x 45/77 = 58% and literature 7 journal produced 58% literature in citation analysis and 27 journals contains only 32 articles 100x32/ 77=41.55% literature.

LOTKA'S INVERSE SQUARE LAW OF SCIENTIFIC PRODUCTIVITY

In 1926, Alfred J. Lotka proposed his inverse square law correlating cotributors of scientific papers to their number of contributers this law provided fundamental theoretical base for bibliometric studies involving authorship.

In the case examined it is found that the number of persons making 2 contribution is about one fourth of those making one contribution, the number making 'n' contributions is about 1/n2 of those making one and the proportion of all contributions is about 60%

In this analysis the law of Lotkas is not fully proved. The analysis are :

The total number authors are 1736. From this data analysed the contribution of number of authors. Then found that, One papers contributed by 1450 authors. 100 x 1450/1736 = 83.52 %. Two papers contributed by 180 authors ,100 x 180/1730 = 10.36% only 10.36% authors contributed only two papers. Three paper contributed by 55 authors out of 1735 then found 100 x 55/1736 = 3.16% Here only 3.16% authors contributed 3 papers Four paper contributed by 25 authors out of 1736 100 x 25/1736 =

1.44%. Only 1.44% authors contributed 4 papers. And Five papers contributed only 10 authors out of 1736. 100 x 10/ 1736 = 0.57%. Other 6 to 16 contributed by 10 authors.. 100 x 10/1730 = 57%.

From this analysis it is clear that the Lotka's law is not fully improved but have some relationship, the reason may be that in modern times single authorship decreased and joint authorship is increased in our data of authorship pattern it is clearly shown that joint authorship are in every year many time to compare single authorship and second level analysis also fulfil this reason.

SECOND LEVEL CITATION ANALYSIS OF SCIENTIFIC PRODUCTIVITY:- The total number of authors are 234 Here

one Papers contributed by100 x 213/234 = 91%

two Papes contributed by 100 x 15/234 = 6.41%

three Papes contributed by 100 x 4/234 = 1.70% etc.

OTHER ANALYSIS

Form 1033 bibliographic reference many essential elements analysed which is very useful in research work.

1. Analysis of year-wise distribution of paper on Pines.
2. Analysis of year-wise authorship pattern in Pines literature.

3. Analysis of language distribution in five year (1994 to 1998) on Pines
4. Analysis of geographical distribution of papers in five years on pines.
5. Analysis of the ranking list of periodicals on Pines literature.
6. Analysis of various list for ranking of authors
7. Analysis of ranked list of institution of the world on pines.

CITATION ANALYSIS

1. Distribution of papers and citation yearwise.
2. Analysis the various form of cited documents.
3. Analysis of the Authorship patterns (Single-joint)
4. Analysis of the ranked list of periodicals .
5. Analysis the distribution of cited year
6. Analysis. of the distribution of half life period
7. Analysed the study of co-citatins.
8. Analysis of scientific productivity of authors.

These all are the other analysis in this bibliometric analysis on pine literature.

CHAPTER-V

CONCLUSIONS

CONCLUSIONS

Bibliometric technique have been gaining recognition and importance, specially during the past two decades. The results of such studies are increasingly being applied to manage the library and information resources and services more effectively and efficiently. This studies is very useful for research work to specific search. The studies of subject literature and their characteristics have also been found useful and helpful in managing the research and development activities in those subject specialities.

By the help of this studies we developed a body of pines literature by some techniques and have affiliated its application for the further growth bibliographic data .

Citation analysis is very useful for further developing bibliographic data. Here by this citation analysis the bibliographic data further provide some systematic tables and sources, for special purpose so citation analysis is a very useful analysis.

Though the present study is confined for five year. This study is intended to find out the literature use pattern by the researchers in the field of Forestry and forestry products.

By bibliographic analysis in pines literature we concluded various area for research use.

1. Year wise distribution of papers during 1994 to 1998 year wise distribution is up-down but 1994 is more productive year in pines research.

2. •Authorship pattern (single and joint authorship) joint authorship many time to compare single authorship but both are similar in nature.

3. Language distribution of items in five year: Enlgish is common language (80% documents contain English) others largely are 20%.

4. Geographical distribution of papers in five: U.S.A CHINA, CANADA, FINLAND are more productive countries.

5. Ranking of periodicals six core journals are found in 132 journals.

6. Ranking of authors: In total 1735 authors, 1450 authors contributing in only one papers and other contributing 2 or more than 2 articles.

7. Ranking list of institution: By this the more productive institution can search in this list 9 institutions are more productive.

CITATION ANALYSIS

1. Distribution of citation in 18 papers during the period 1994-98.
2. Type of documents cited: By the citation analysis six more productive form of document cited. In all journals and book are core.
3. Cited authorship: In cited authorship single and joint are found in alternative form.
4. Ranking list of cited journals: In 34 journals only 3 journals are more cited in 77 references only 3 journals contains 27 references, from 18 papers citation analysis.
5. Ranking of authors: In total 231 author only 21 author contributing in More than 2 cited form of document.
6. Cited year of document: 49 years cited in all only three year are more cited. , 1982, 1986, 1977.
7. Co-citation: Only four document are citing two times in citation analysis on pines literature.

These various data concluded by the help of bibliometric analysis so at last we can say that bibliometric analysis is a essential service for a information centres and libraries..

CHAPTER-VI

BIBLIOGRAPHY OF SOURCES AND REFERENCE CARDS

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